MONTHLY WEATHER REVIEW.

Editor: Prof. Cleveland Abbe. Assistant Editor: Frank Owen Stetson.

Vol. XXXIV. NOVEMBER, 1906. No. 11

The Monthly Weather Review is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Anastasio Alfaro, Director of the National Observatory, San José, Costa Rica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian, which is exactly five hours behind Greenwich time, is used in the text of the Monthly Weather Review.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

RECORDS OF THE DIFFERENCE OF TEMPERATURE BETWEEN MOUNT ROYAL AND McGILL COLLEGE OBSERVATORY, AND A METHOD OF LOCAL TEMPERATURE FORECASTING.

By C. H. McLeod, Superintendent of the Meteorological Observatory, and H. T. Barnes, Associate Professor of Physics, McGill University.
Dated Montreal, Canada, December 5, 1906.

In 1897 the British Association made a grant of £50 toward an investigation of the changes of temperature due to differences in altitude at Montreal. In the early summer of 1899 suitable electric recording instruments were installed in the McGill College Meteorological Observatory, and a wire connection was established between the observatory grounds and a tower, 47 feet high, placed on the summit of Mount Royal. The thermometers were of the ordinary electrical-resistance type, of 10 ohms, composed of coils of .006-inch platinum wire wound on mica frames. The two thermometers constituted a differential pair, and were in consequence carefully adjusted to equality.

The general principle of the Wheatstone's bridge connections for the electrical-resistance thermometer, as designed by Professor Callendar, is already well known. The method of compensation, which consists in placing in the opposite arm of the bridge a loop of wire equal in length and resistance to the thermometer leads and stretching over precisely the same path, renders the records independent of variations of temperature in the connections. These may, therefore, be made of any length desired. Until these records were obtained no test had been made of this compensation system over so great a distance, and it was consequently a matter of some interest to observe how well the method served.

The mountain thermometer is placed near the top of the tower, and is approximately 800 feet above sea level. It is protected by a single screen cage commonly used for protecting observatory thermometers. The cage is hung from the underside of the topmost platform of the tower and is, therefore, protected from the effects of direct radiation. The observatory thermometer is placed four feet above the ground in the cage used for protecting the standard mercury thermometer, and is 187 feet above sea level. The difference in elevation between the two thermometers is therefore 620 feet, and the position of the mountain thermometer is northwest from the observatory. The horizontal distance between the stations is 3300 feet, and the actual length of connecting cable is 4100 feet. The first connection that was made between the mountain top and the observatory was with four ordinary electric light wires of No. 14 gage. These were supported on glass insulators on poles placed at intervals up the side of the mountain. By this means records were obtained of the difference in temperature between the high and low levels during fine and dry weather, but in wet weather the insulation proved so defective as to render successful operation impossible.

It was not until 1903 that a satisfactory cable could be procured and placed in position. A special telephone cable containing eleven paper-covered No. 14 copper wires surrounded by a lead cover was hung from a stout wire supported on the poles. Four of these wires were used for the thermometer circuits, and the remaining wires were used for the anemograph and other instruments required on the tower for the meteorological work. Two of the four wires were used for the thermometer connection proper, and the other two for the compensating loop. Each pair of wires measured 40 ohms resistance.

The readings were commenced under the improved conditions in July of that year, and have extended to the present time, with the exception of two unavoidable delays during the summers of 1904 and of 1905. These were caused by defective repairing of a cut made in the mountain line by some unknown person.

One of the Callendar electric recorders is used to obtain permanent traces of the difference in temperature, and it is arranged to operate on the 100-volt direct-current lighting circuit thru a 16-candle-power lamp.

The pen marking on the record sheet is drawn to one side or the other of the line of equal temperatures, depending on whether the mountain thermometer is warmer or colder than the one at the observatory. A D'Arsonval galvanometer is provided with a light arm about six inches long containing two wires which make metallic contact with two wires on the circumference of a wheel operated by clockwork. Either one or the other wire of the arm touches the corresponding clockwire, depending on the deflection of the galvanometer. When

the bridge balance is upset electrical connection is thus made to either of the relays situated to the right and left of a bridge wire 12 inches long. The relays operate clock mechanisms and draw the contact point over the wire to the right or left, depending on the deflection.

The contact point is rigidly attached to the pen recording on paper attached to a drum driven by clockwork. The movement of the contact is in such a direction as to reestablish the balance in the bridge system.

A great deal of attention was directed to the tracing of the base or zero line when all the connections were in the circuit and the thermometers were maintained at equal temperatures. This affords the best check of the efficiency of the compensation system at different seasons of the year. It was seen that the zero line showed small fluctuations on either side, perhaps due to small strains in the wires from wind or other causes, but recently we have very much improved the insulation of the cable, and have to a large measure done away with much of the fluctuation. The deviations were of a magnitude represented by about a degree Fahrenheit on either side of the zero line on the chart, but over the twenty-four hours they averaged out.

When even-ratio coils are attached to the recorder in place of the mountain wires, a perfectly straight line is obtained. The scale is so arranged that a difference of 1° F. between the two thermometers displaces the pen horizontally two small divisions, or two-tenths of an inch. Every large division is one-half an inch and equals 2.5°. The time scale in the direction of revolution of the drum is one-half inch per hour.

It has been arranged that a displacement of the pen to the right indicates warmer on the mountain, while to the left indicates colder conditions. We have arbitrarily called these positive and negative differences, respectively, thus indicating the way the difference has to be applied to the thermograph records of temperature at the observatory to obtain the temperature on top of the mountain.

ANALYSIS OF THE RECORDS.

TABLE 1.—*Average monthly differences in temperature, in degrees F., between summit and base of Mount Royal, Montreal.*

Month.	1903-4.	1904-5.	1905-6.
July	−5.5	....	....
August	−4.7	....	....
September	−5.8	....	....
October	−7.6	....	....
November	−4.6	....	....
December	−8.2	....	−3.0
January	−11.6	....	−2.2
February	−8.1	−2.7	−1.6
March	−5.9	−2.0	−2.5
April	−6.8	−3.1	−3.7
May	−3.7	−2.6	....
June	....	−2.2	−2.5

A study of the various records which we have obtained shows that the temperature at the top of the mountain is normally lower than at the observatory. The accompanying table shows the average monthly differences which so far have been deduced. Each value represents the mean for days of the month and in every case the value is negative. The daily means were obtained from the trace by averaging the values read off at hour intervals. The differences for 1903-4 are conspicuously greater than for the two following years. Whether this fact is in any way connected with the severe weather which was experienced in Montreal during 1903-4 is a matter yet to be settled. It is a striking fact that the average monthly means for the temperature at the observatory from July, 1903, to December, 1905, with only three exceptions, were all below the average for the past thirty years, the departure in two cases amounting to as much as 8° F.

A further significant fact is that smaller differences have preceded or accompanied the mild winter and warm summer of 1906, when the observatory temperature for every month up to date, except two, has been above the average for the past thirty years. January, 1906, was over 8° F. above, while the exceptions, May and July, were less than 3° below the 30-year average.

An interesting feature of our work is the way the trace may be used to predict temperature changes for a short period ahead. It appears that our high-level thermometer is always affected first by any temperature change, and that the time interval may be from five to twenty-four hours in advance of the low-level. Thus a warm or cold wave passes over the mountain first and subsequently comes down to the lower level; the effect is observed on the trace by the traveling of the pen to the right or left and its subsequent return to the normal difference.

In general we find:

(1) Steady normal negative difference (colder on the mountain) indicates continued temperature conditions at the lower station.

(2) Increasing negative difference indicates that the temperature conditions will grow colder at the lower level.

(3) Decreasing negative difference indicates that the temperature will rise at the observatory.

(4) A positive difference indicates a rise of temperature at the observatory.

(5) An increasing or decreasing positive difference indicates changes similarly to a decreasing or increasing negative difference.

The magnitude of the change at the lower station can usually be surmised by observing the magnitude of the change in the differential reading.

A positive wave on the trace has been observed to accompany a heavy fall of snow, as tho rapid crystallization in the upper atmosphere had resulted in a sensible evolution of heat. The direction and velocity of the wind affect the results to a certain extent. Thus the direction frequently determines the approach of colder or warmer weather, and the velocity fixes, to some extent, the time interval between the stations, since a high wind tends to mix the air currents.

The accompanying figures, reproduced from a series of traces, serve to illustrate our meaning. Figs. 1 and 2 are somewhat remarkable from the very large differences indicated. They were obtained on February 1 and 2, 1904, and heralded a considerable temperature depression. The scale is indicated in Fahrenheit degrees, positive above and negative below the zero line. The horizontal scale is for twenty-four hours, beginning with midnight. In fig. 1 the difference increases negatively after 3 a. m., dropping rapidly until 9 a. m., and then remaining fairly constant until 6 p. m., when it drops off more rapidly, until between 11 p. m. and 12 midnight the difference between the summit and the observatory reached as much as 24°. Fig. 2 shows this large difference maintained the next day, with waves of colder air sweeping over the summit at intervals. The character of these records was that of extremely cold weather. Thus, altho fig. 1 indicated a change at 3:30 a. m., showing mountain temperature falling from 22° and reaching 18° at 8:45 a. m., the observatory temperature rose in the same time from 24° to 28°. At this point a sudden change in wind took place, indicated by the small hump at 9 a. m., and the mountain and observatory temperatures fell away together, reaching 0° and 10°, respectively, in about an hour. From 10 a. m. on they remained relatively the same, until at 3 p. m. a great change was indicated. Thus the observatory temperature fell to −10° and the next day reached −20°. On the summit −45° was recorded. Indications of the cold wave extending to the ground in some places were afforded by reports that the mercury had frozen in the thermometers in certain districts. Such a report was received from St. Rose, 20 miles to the north of Montreal. All thru

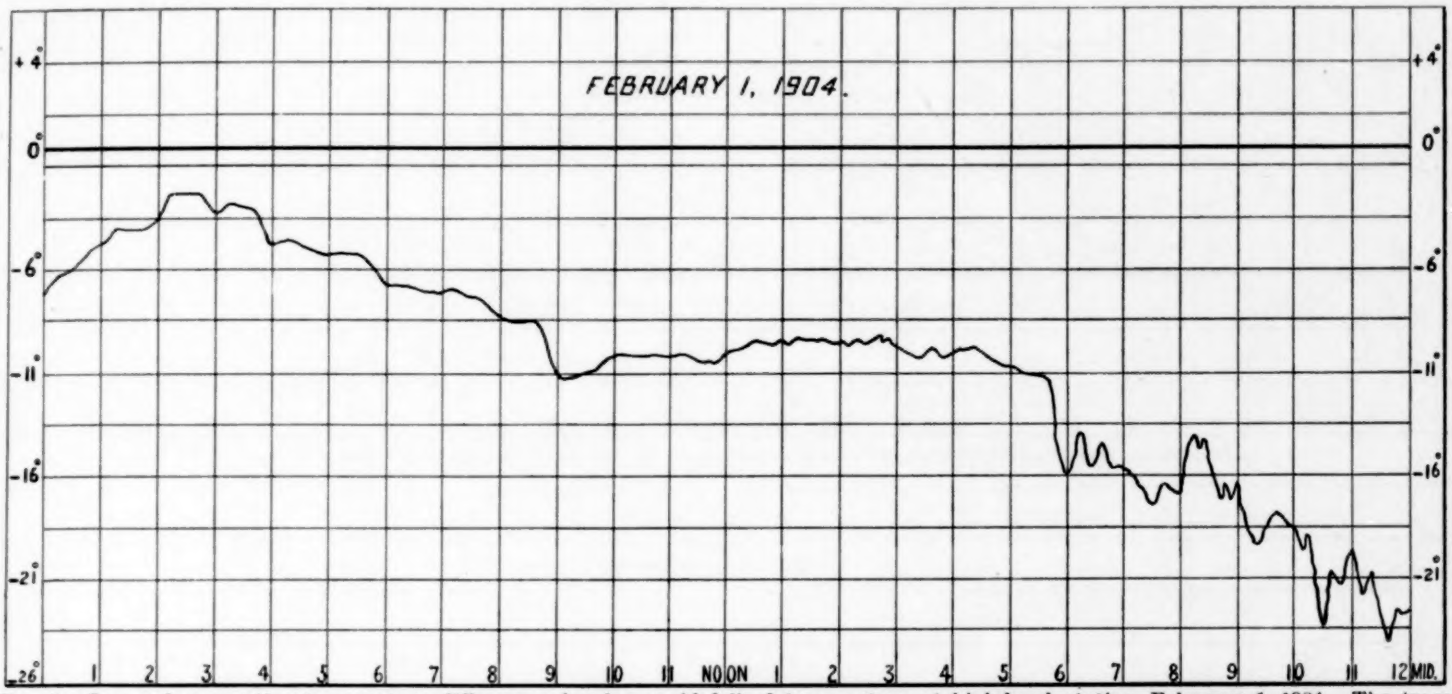

FIG. 1.—Increasing negative temperature difference, showing rapid fall of temperature at high-level station, February 1, 1904. The trace shows the temperature difference in degrees Fahrenheit, the high-level temperature minus the low-level temperature.

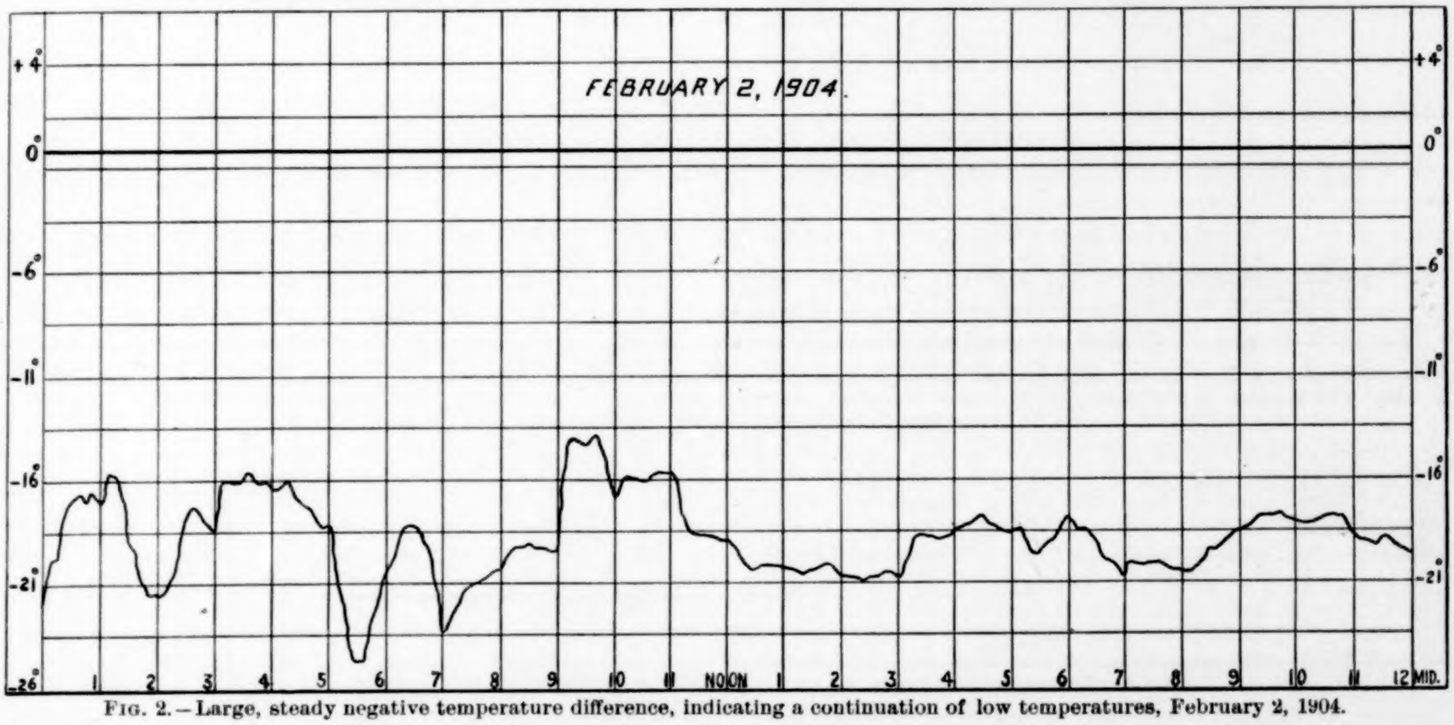

FIG. 2.—Large, steady negative temperature difference, indicating a continuation of low temperatures, February 2, 1904.

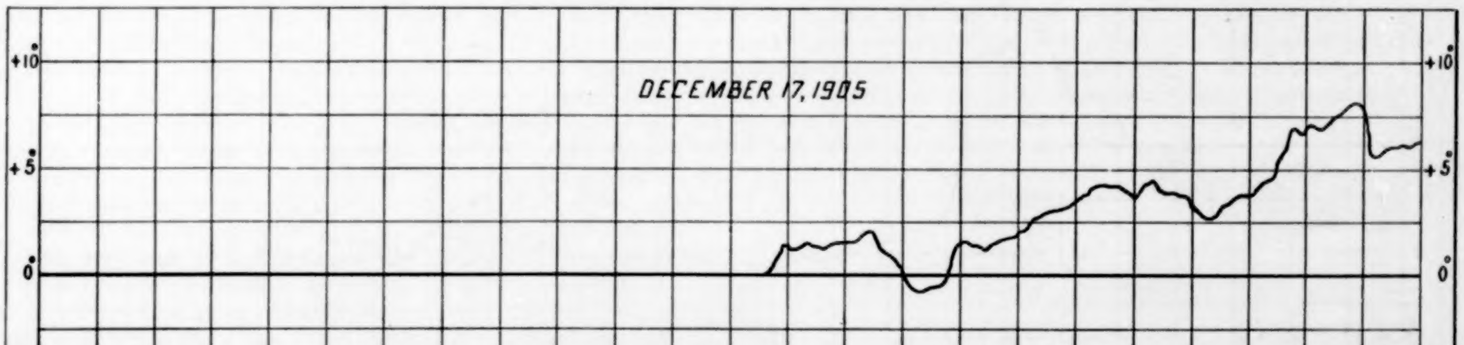

FIG. 3.—Increasing positive temperature difference, showing warm wave passing over high-level station, December 17, 1905.

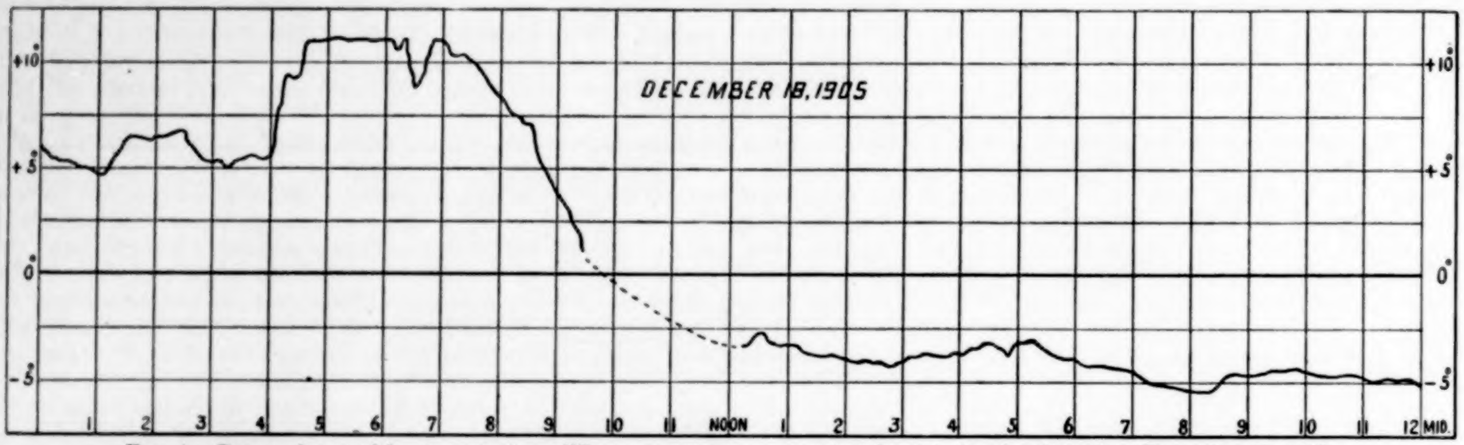

FIG. 4.—Decreasing positive temperature difference; warm wave coming down to low-level station, December 18, 1905.

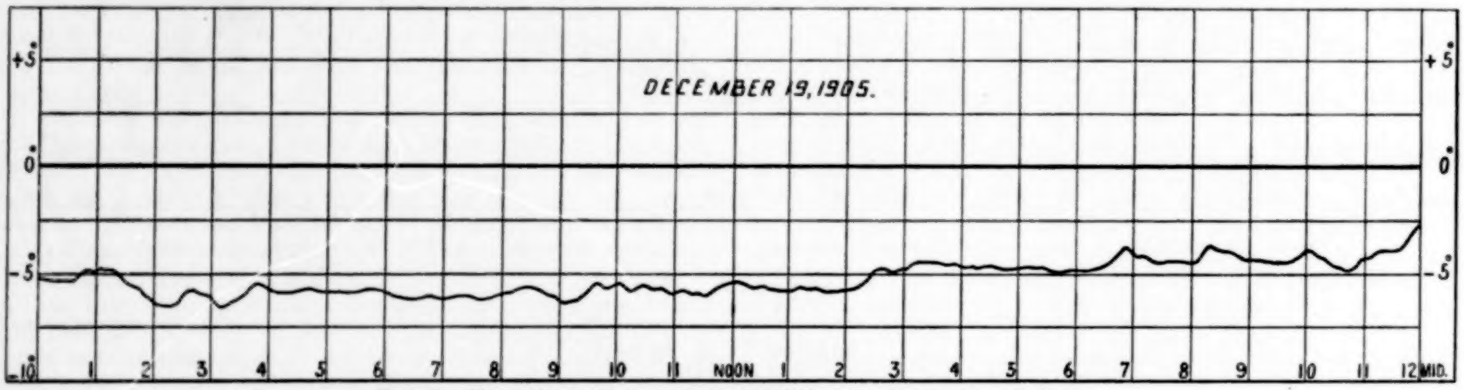

FIG. 5.—Normal negative temperature difference, December 19, 1905.

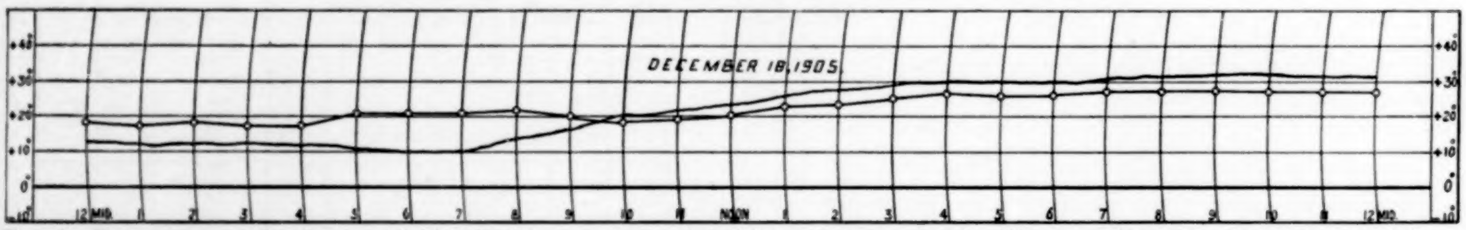

FIG. 6.—Thermogram at low level, with high-level temperatures plotted from the trace showing differences, December 18, 1905. (The dots on the hour lines indicate the high-level temperatures.)

FIG. 7.—Thermogram at low level, with high-level temperatures plotted, December 19, 1905.

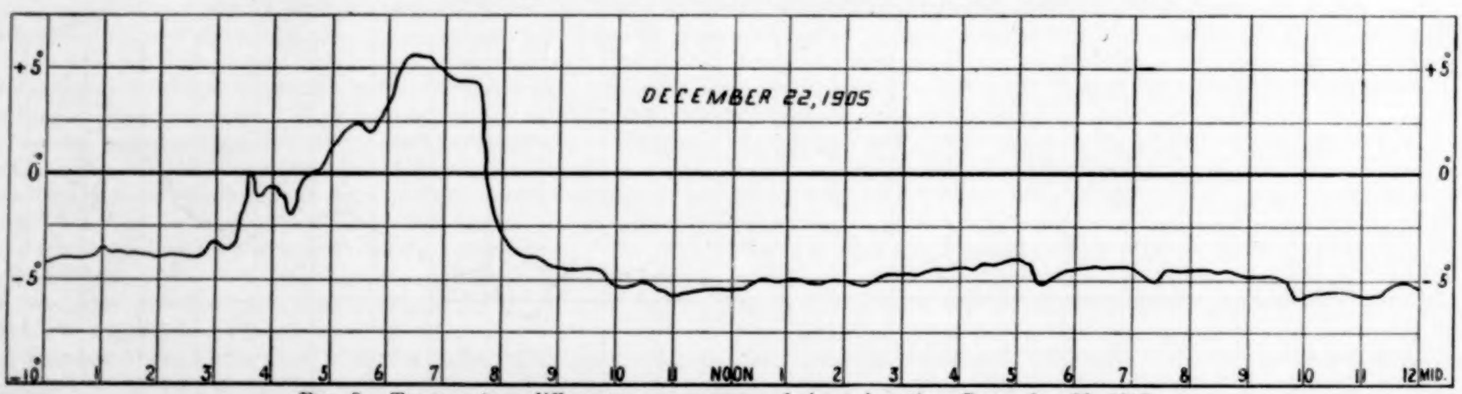

FIG. 8.—Temperature difference; warm wave of short duration, December 22, 1905.

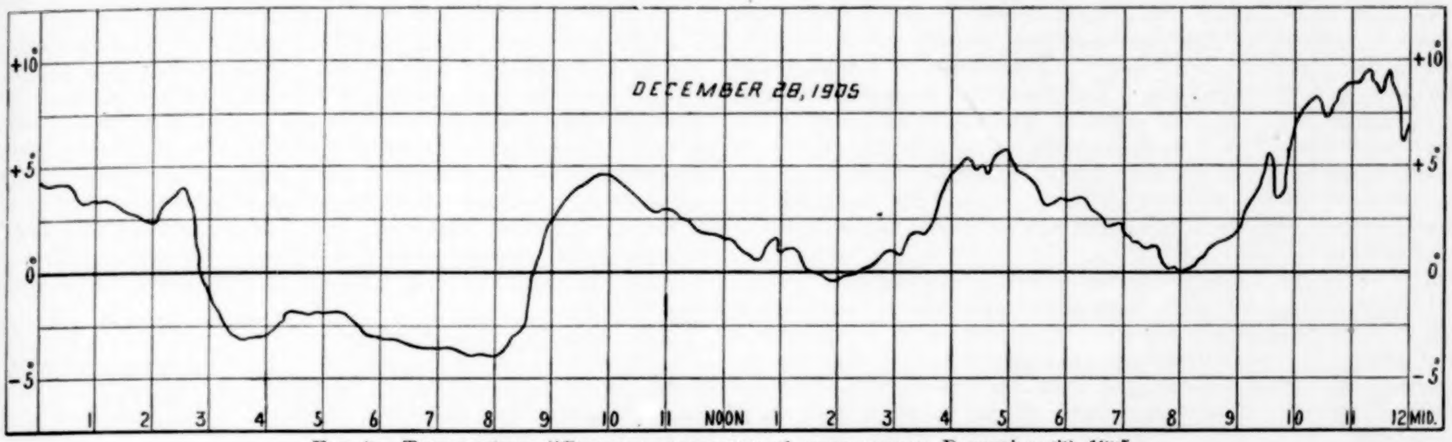

FIG. 9.—Temperature difference; succession of warm waves, December 28, 1905.

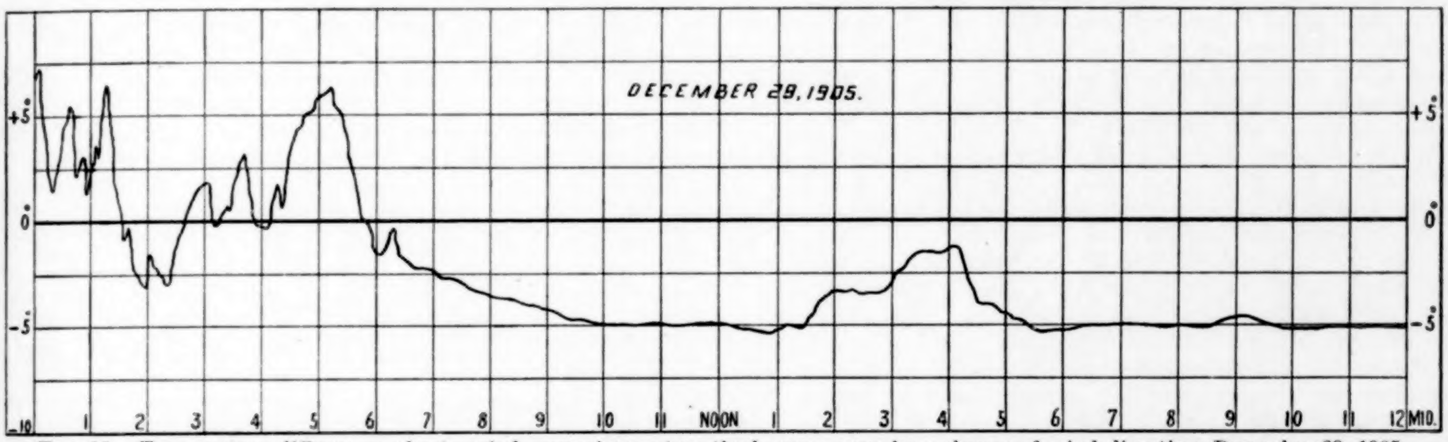

FIG. 10.—Temperature difference; short period waves imprest on the longer waves by a change of wind direction, December 29, 1905.

this month very large negative differences were recorded, and the severity of the weather may be gathered when it is observed that the average temperature at the observatory for the month is recorded as being over 8° below the mean for the previous thirty years. The average difference between the summit and observatory for that month was 11°, which is the largest average monthly difference so far obtained.

The remaining figures give the recorded differences and the temperatures at the observatory for part of December, 1905, in illustration of our method of temperature forecasting.

At noon on December 17 (fig. 3) the temperature on the mountain became warmer than at the lower station, and so continued for ten hours. The temperature at the lower point during this time fell slightly until after 7 a. m. on the 18th (fig. 6), when the change to warmer weather began, and extended thru more than 20°.

Before 10 a. m. on the 18th (fig. 4), while the temperature at the lower station was still increasing (fig. 6) the differential record rapidly returned to zero, and then showed a negative difference which continued to increase, at first rapidly and then slowly, for about sixteen hours. The change to lower temperature at the observatory took place at about 1:30 a. m. on the 19th (fig. 7) and continued thru 15°. The interval here noted between the change to a minus difference and the commencement of cold weather at the lower station amounted to sixteen hours. A difference of upwards of 5° was maintained between the stations for about twelve hours (fig. 5), indicating steady cold at the lower station, after which the difference decreased slightly until midnight of the 19th. Shortly afterward the approach of a warm wave was noted by a return to zero, and the lower station showed the expected change some ten hours later (10 a. m. of the 20th). In this case the recorded difference only just reached zero, and after four hours fell away from it. As was to be expected, the temperature change at the lower station was of correspondingly small dimensions.

After this the record remained at or slightly below the normal difference for the month, and no considerable change occurred in the air temperature until the 22d at 8 a. m. (fig. 8), when the approaching change was heralded by the differential thermometer at 3 a. m., or only five hours in advance. Again the plus indications were of slight duration and the warm period similarly brief. The following two days gave a period of steady temperature with a gradual approach to colder weather on the evening of the 24th, and no considerable fluctuation in difference from −5° until midnight on the 24th, when for a few hours the record showed a plus value, reaching +3°, and the air temperature rose to 30° at noon the following day, the 25th. Similar cases of advanced warning may be observed in the following days: A very extensive deviation to the plus side continued from 3 p. m. on the 27th to 6 a. m. on the 29th (figs. 9 and 10), and was followed by the long period of warm weather covering the greater part of the 28th, and the 29th, 30th, and 31st, and altho a normal minus deviation was recorded as early as 10 a. m. on the 29th (fig. 10), colder weather did not set in until midnight of the 30th. These results, presented in tabulated form to show the interval of warning of an approaching change in temperature, are as follows:

Time at which change was noted on differential record.		Character of indication.	Time at which expected change occurred at lower station.		Interval of warning.
1905.	Hour.		1905.	Hour.	
December 17	12 noon	Warmer	December 18	7 a. m.	19 hours.
December 18	10 a. m.	Colder	December 19	1:30 a. m.	16 hours.
December 19	12 midnight.	Warmer	December 20	10 a. m.	10 hours.
December 22	3 a. m.	Warmer	December 22	8 a. m.	5 hours.
December 24	12 midnight.	Warmer	December 25	12 noon	12 hours.

Figs. 6 and 7 show the temperatures obtained from figs. 4 and 5 plotted on the thermograph records which are obtained daily at the observatory. This shows at a glance the character of the deviations. The mountain temperatures can be obtained from the plot which is marked by the dots at the hour intervals. Fig. 9 is interesting as showing a series of warm waves of about 5-hour period, which is followed by fig. 10, showing waves of about 1-hour period, the temperature finally settling down to a steady negative difference the following day.

Elsewhere we have published a larger number of traces,[1] but the examples we give here illustrate what we are obtaining from our mountain records. It is very much to be desired that similar traces should be obtained at other stations for comparison. The question of how far the results we have obtained are due to any peculiarity of our location has yet to be settled.

Mount Royal is one of the Monteregian hills, of which there are several, all of volcanic origin, which rise above a very flat country. The nearest of these hills is Mount St. Bruno, 14 miles to the east, with an elevation of 560 feet. Beloeil Mountain comes next, about 24 miles from Montreal, but is considerably higher, about 1400 feet.

We desire some time to erect a thermometer on the summit of one of the higher mountains, such as Beloeil, but lack of funds renders this out of the question at the present moment.

The observations which have been made by Prof. J. E. Church, jr.,[2] on the summit of Mount Rose, to which our attention was directed by Professor Abbe during the past summer, seem to indicate similar advance changes. The observations are exceedingly difficult to obtain, and the heroic efforts of Professor Church to establish the Mount Rose Weather Observatory are vividly described in his interesting paper. The altitude of Mount Rose is 10,800 feet, vastly greater than the altitude of our high-level instrument, but the character of the mountain is that of a peak rising by itself, isolated from other land masses, similar to our more modest Mount Royal. Professor Church has compared the thermograph records obtained on the summit with similar records obtained at Reno, 6268 feet below, and finds advance times of warning for temperature changes at the lower level. Thus at noon on May 14 a period of low temperature set in on the mountain top thirty-six hours before the first appearance of frost in the adjacent valley. The time interval for a depression of temperature on Mount Rose to reach the region below at Reno is placed at from twenty-four to thirty-six hours. The time interval of warning which we have observed is shorter than that noted by Professor Church, but this is no doubt due to the very great difference in the altitudes of the respective stations. In one case it was observed that a gale of 40 miles per hour was met by the observer on the mountain top six hours in advance of its arrival at Reno. Here the high wind seems to have lessened the time of warning for the storm, just as we have found that a high wind with cold lessens the interval of the temperature fall at the lower station.

Should the time interval of warning be a question of altitude, as indicated by a comparison of Professor Church's results and our own, it would be of great interest as indicating the height at which meteorological changes have their origin. Simultaneous observations of temperature at different altitudes would thus be most instructive, when obtained on a recording apparatus such as ours placed at a low-level station. We believe that the complete success of this method of temperature forecasting depends on knowing at once the difference of temperature between the high and low levels. Thus several such arrangements would give at any moment the temperatures at various altitudes compared with a common level.

[1] Trans. Roy. Soc. Can., vol. 10, pp. 71-121 (1904), and vol. 12 (1906).
[2] Monthly Weather Review, June, 1906, Vol. XXXIV, p. 255.

COLLAPSE OF A HOLLOW LIGHTNING ROD.

In Nature, London, July 5, 1906, page 230, Prof. J. A. Pollock, of the University of Sydney, N. S. W., describes a lightning stroke passing down a hollow rod used as a lightning conductor, and crushing it inwards. As the copper was about one millimeter thick considerable force would be required to do this, but as the diameter of the rod is not given nothing more definite can be stated as to the necessary pressure.

It is well known that a lightning flash involves the sudden expansion of the air in the direct line of discharge, thus producing an explosive effect, which is doubtless the origin of the thunder.

The intensity of this effect may be greatly reinforced by the sudden conversion into vapor of any masses of water or other liquid that may lie in the path. In this way the bursting asunder of the limbs and bodies of trees and the boring of trenches in the ground is explained.

The collapse of the copper tubular conductor is attributed by Professor Pollock to compression produced by the electrodynamic action of the current when the tube was hot and plastic. An equally plausible explanation is offered by Dr. Irving Langmuir of New York, who has been investigating the dissociation of gases and vapors around highly heated wires, as set forth in the following letter of August 22.

In reply to your letter of August 18, I would say that it is not possible that the dissociation of water vapor on the surface of a hollow lightning rod could account for pressures sufficient to make the rod collapse. At the melting point of copper (1084° C.) the dissociation of water vapor under atmospheric pressure is only 0.005 per cent and even at the melting point of platinum (1710° C.) it is less than 1 per cent. Under higher pressure the dissociation is still less. Furthermore the dissociation, *even if complete*, would increase the pressure only 50 per cent—a small amount compared to the pressure due to the heating of the gases around the rod.

I would suggest as an explanation of the phenomenon the practically instantaneous (explosive) vaporization of a layer of water on the outside surface of the tubular rod. Even a thin film, if converted rapidly enough into steam, could produce very great pressure.

Even without the presence of a film of water the pressure might be produced by the explosive expansion of the air near the outer surface of the rod. It is probable that the air inside the tube would not be heated so rapidly or to such a high temperature as the air outside the tube, because the current thru the rod, being oscillatory, would practically be confined to the outer layers.

In a later letter, dated September 18, Doctor Langmuir remarks:

Professor Pollock's explanation is interesting. * * * I do not know whether he made any calculation to see whether the electromagnetic forces would be of the order of magnitude required to crush a copper tube. The problem interested me, so I endeavored to make such a calculation. According to Pockel, W. Kohlrausch, and L. Weber the current in a lightning discharge is, on the average, 10,000 amperes, with a maximum value of 20,000 amperes. Taking this last figure as the basis for the calculation, and assuming the outside diameter of the rod to be 1 centimeter and the inside diameter 0.8 centimeter, I find that the electromagnetic force on the outside of the tube would be equivalent to a pressure of 42 pounds per square inch. This would cause compressive stresses in the tube of 210 pounds per square inch. This is calculated on the assumption that the current flows uniformly thruout the cross section of the copper of the tube. If the current is limited to the outside layers, because of its oscillatory character, the pressure would be about 14 per cent less.

A similar calculation, worked out for the case that the outer diameter is 0.4 centimeter and the inner diameter 0.2 centimeter, gives for the pressure 330 pounds per square inch, and for the stress in the copper 670 pounds per square inch. With an oscillatory current the pressures would be about 35 per cent less than these.

It hardly seems probable that such small pressures lasting for such a very short time as that during which the discharge lasts could produce the collapse of the rod. Copper does not become very soft when heated below its melting point, so we would not expect it to yield to pressure of such small magnitude. * * *

Of course the data on which the above calculations are based are too uncertain, and the results come out too nearly of the order of magnitude necessary for the crushing of the rod, to enable one to prove conclusively that the electromagnetic force is not the cause of the collapse. The pressure is proportional to the square of the current, so that a current of 40,000 amperes would produce four times the effects calculated above.

STUDIES ON THE THERMODYNAMICS OF THE ATMOSPHERE.

By Prof. FRANK H. BIGELOW.

IX.—THE METEOROLOGICAL CONDITIONS ASSOCIATED WITH THE COTTAGE CITY WATERSPOUT—Continued.

THE MAXIMUM FALLING VELOCITY FOR RAIN IN THE LOWER ATMOSPHERE.

The velocity in meters per second which just sustains a freely falling body in the atmosphere has been computed by formula 37, Table 56:

$$w = 7.503\sqrt{\frac{T}{B} D \rho_w \frac{1}{k}},$$

where T is the absolute temperature, B the barometric pressure in centimeters, D the diameter in centimeters, ρ_w the density of the falling body in grams per cubic centimeter, and k the so-called friction factor, ranging from 1.0 to 1.9. In view of the many combinations which can occur between these terms, an extensive series of tables would be required to express the results in final values of w, the velocity in meters per second. I have, therefore, in Table 56, separated the formula into its three constituent parts, for convenience,

$$w = 7.503\sqrt{\frac{T}{B}}, \quad \sqrt{D \rho_w}, \quad \text{and} \quad \sqrt{\frac{1}{k}}.$$

The reader should select the values that are appropriate for the case in hand and make the necessary multiplications in order to find the maximum falling velocity. This may be properly illustrated by the example of rain, which will require some further modifications, because of the facility with which water in the atmosphere can take on different sizes, since drops occur ranging in diameter from 0.01 to 7 mm. In the case of rain $\rho_w = 1.0$, and we select $k = 1.0$, tho it will be shown that this is correct only for common drops from 0.20 to 1.50 mm. in diameter. For convenience we take $w = 7.503\sqrt{\frac{T}{B}} = 15.0$ m. p. s., since this is the value prevailing in the lower strata of the atmosphere at common temperatures. In the Meteorologische Zeitschrift for June, 1904, Prof. P. Lenard of Kiel has a valuable article on rain, which will be used in this connection as it affords some experimental data of importance and is generally in agreement with the results of the discussion already described in the preceding pages.

Table 66, Bigelow's formula for rain, contains the computation for rainfall, where the drops are divided into three classes:

I. Diameter, $D = 2r$, from 0.01 to 0.20 mm.
II. Diameter, $D = 2r$, from 0.30 to 0.50 mm.
III. Diameter, $D = 2r$, from 1.00 to 5.50 mm.

Since the C. G. S. system of units is employed the values of $D = 2r$ must be exprest in centimeters, as in the second column; the third column contains $\sqrt{D}$, and the fourth $w = 15\sqrt{D}$, which is the required velocity in meters per second.

TABLE 66.—*Bigelow's formula for rain.*

$$w = 7.503\sqrt{\frac{T}{B} D \rho_w \frac{1}{k}}.$$

For rain in lower atmosphere, take $\rho_w = 1.0$ for water, and $k = 1$.

Take $7.503\sqrt{\frac{T}{B}} = 15.0$ m. p. s. approximately.

I. FOR FINE DROPS, 0.01 to 0.20 mm.

$D = 2r$		$\sqrt{D}$	$w = 15\sqrt{D}$	$w = \frac{2g}{9\mu}r^2$
mm.	*cm.*		*m. p. s.*	*m. p. s.*
0.01 =	0.001	0.032	0.48	0.0032
0.02 =	0.002	0.045	0.67	0.0127
0.03 =	0.003	0.055	0.83	0.029
0.05 =	0.005	0.071	1.07	0.079
0.10 =	0.010	0.100	1.50	0.32
0.20 =	0.020	0.142	2.13	1.27

II. FOR COMMON DROPS, 0.30 to 0.50 mm.

$D = 2r$		$\sqrt{D}$	$w = 15\sqrt{D}$	$w^2 = \frac{g}{\gamma\rho} \cdot r$
mm.	*cm.*		*m. p. s.*	*m. p. s.*
0.30 =	0.030	0.173	2.60	2.73
0.40 =	0.040	0.200	3.00	3.15
0.50 =	0.050	0.223	3.35	3.53

III. FOR LARGE DROPS, 1.00 to 5.50 mm.

$D = 2r$		$\sqrt{D}$	$w = 15\sqrt{D}$	Obsn.	$\sqrt{1/k}$	k
mm.	*cm.*					
1.00 =	0.100	0.316	4.74	4.40	0.98	1.1
1.50 =	0.150	0.387	5.81	5.70	0.94	1.1
2.00 =	0.200	0.447	6.71	5.90	0.88	1.3
2.50 =	0.250	0.500	7.50	6.40	0.85	1.4
3.00 =	0.300	0.548	8.22	6.90	0.84	1.4
3.50 =	0.350	0.592	8.88	7.40	0.83	1.5
4.00 =	0.400	0.632	9.48	7.70	0.81	1.5
4.50 =	0.450	0.671	10.07	8.00	0.79	1.6
5.00 =	0.500	0.707	10.61	8.00	0.76	1.8
5.50 =	0.550	0.742	11.13	8.00	0.72	1.9

For fine drops, I, w ranges from 0.48 to 2.13.
For common drops, II, w ranges from 2.60 to 3.35.
For large drops, III, w ranges from 4.74 to 11.13.

These results are obtained by applying the same law for all drops, from the finest to the largest which occur in the atmosphere. This must, however, be modified for fine drops, I, and for large drops, III, in order to conform to the experimental observations. When the drops are very fine the viscous resistance of the air becomes the prevailing force that holds them from falling, and by formula 64, Table 62, the maximum falling velocity is permanent for

$$w_m = \frac{2}{9}\frac{g}{\mu}\frac{\rho}{}\left(\frac{\rho_w}{\rho} - 1\right) r^2 = \frac{2}{9}\frac{g\,r}{\mu}\,(\rho_w - \rho).$$

By taking $(\rho_w - \rho) = 1.00 - 0.00129 = 1.00$, this becomes $w_m = \frac{2}{9}\frac{g\,r^2}{\mu}$, which is the formula employed by Lenard for fine drops. In this $g = 981$ cm., $\mu = 0.000172$, by formula 55, Table 62, and r is taken in centimeters. The result in the fifth column ranges for fine drops from 0.0032 to 1.27 m. p. s., and they are much smaller than those given by the general formula.

In the case of common drops, Lenard uses the formula $w^2 = \frac{g}{\gamma\,\rho}\,r$, where $g = 981$ cm., $\rho = 0.00129$, and $\gamma = 0.153$, a constant derived by experiment. The results range from 2.73 to 3.53, and are in close agreement with the general formula, where $k = 1.0$. This shows that the formula for impact resistance as distinguished from viscous resistance begins to be applicable for drops whose diameters are about 0.25 mm. The fact that $k = 1.0$ indicates that the common drops do not experience any deformation relatively to the passing stream lines, the surface tension being strong enough to simply adjust the shape of the drop to the curvature required for avoiding any resistance due to the shape of the body, except that tangential to the surface of the drops. When the drops increase in size beyond 0.50 mm. a deformation sets in which it is important to describe more fully.

Professor Lenard's experiments on large drops, with diameters 1.00 to 5.50 mm., were conducted by means of a machine which produced a vertical current whose velocity could be regulated and measured. In the midst of this the water drops falling from above were made to float, and their sizes when in equilibrium were studied. The resulting velocities for corresponding diameters are given in column 5 of section III, and they range from 4.40 to 8.00 m. p. s. It was seldom that larger drops than 5.50 mm. survived without breaking up, and the

maximum current was 8 m. p. s. If we divide this experimental value of the vertical velocity by the computed velocity in column 4, we find the ratios $\sqrt{\frac{1}{k}}$ in column 6, section III.

We take out the corresponding values of k which are placed in the last column of Table 66, where they range from 1.1 to 1.9. We may, therefore, render the general formula for w applicable to raindrops of different sizes by taking k=1.0 for common drops, and gradually increasing its value for large drops from k=1.1 to k=1.9, as indicated in the table.

In his experiments on the deformation of raindrops in a vertical current of air, which could be well observed, Lenard found that the first effect of the current on the shape of the drop was to flatten it so that the axis parallel to the direction of the current was shortened. A further increase of velocity produced an increase of surface friction along the meridians of the drop, which also set up oscillations, and gradually produced vortex ring motion around a circle in the outer portion of the drop, lying in a plane perpendicular to the motion of the current. This vortex ring then separated into a corona of beads, the ring breaking up into smaller drops which became individuals, and broke up the large drop into fine drops. The fine drops began to increase in size by means of two processes, (1) *collisions* of drops in the current, (2) the attraction of drops by means of the *electric charges* which always accompany the aqueous vapor in its various stages of ionization. Lenard made counts for the number of drops of different sizes occurring in several rains and found that the number of fine drops is greatly in excess of that for large drops. The series of assorted sizes does not change regularly from the smallest to the largest, but they accumulate in groups, some sizes being entirely wanting, tho the number of large drops in any group is not so great as in the groups of small diameters. There is a continual interchange in the sizes and numbers in each group because of the growth, deformation, and separation of large into small drops. It is evident that the true physical values of the surface tension in drops can be obtained by computations on such data as that found in this manner. In the quiet air of the Tropics where the aqueous vapor content is great the drops may sometimes grow to a diameter of 7.0 or 8.0 mm., tho that is not common. The time of oscillation in the process of deformation and disintegration is apparently two or three seconds. The subject of rain invites to more exact experimental research than has yet been bestowed upon it.

THE PROBABLE VERTICAL VELOCITY IN THE CLOUD.

It is desirable to obtain some idea of the vertical velocity within the cloud itself for the purpose of judging of the validity of certain theories which have been proposed to account for the formation of heavy hailstones. The formula to be employed is

$$w^2 = 574.06 \frac{T}{B} \Delta B,$$

in the adopted system (M. K. S.) where B and ΔB are in meters, tho, since they occur in the ratio $\frac{\Delta B}{B}$, they can be taken in millimeters; w is the velocity in meters per second. Referring to the data for the waterspout in Table 51, we find the quantities available for the discussion. It is evident that there is no difficulty regarding T or B, but that the value to be assigned to $\Delta B = B_0 - B$ is very uncertain. At first I take B_0 as the static pressure in the normal system of gradients as obtained from the Barometry Report, and B the pressure computed as above from the observed cloud conditions.

α-stage.

(See Table 51. Summary of data.)

The pressure at sea level is .... 763.27 mm.
The gradient in the static state is −8.24 mm/100 m.
The height is 10.78 × 100 meters.
The pressure fall is .... −88.83 mm.

B_0 = pressure at cloud base in static state 674.44 mm.
The gradient in the convection state is −8.46 mm/100 m.
The pressure fall for 10.78 × 100 meters is ..... −91.20 mm.

B = pressure at the cloud base in convection state (763.27 − 91.20) ... 672.07 mm.
$(B_0 - B)_\alpha$ = difference of pressure at cloud base 2.37 mm.
T = temperature (absolute) at base of cloud (273 + 9.3) .... 282.3°
w_α = vertical velocity at the top of the α-stage .... 23.91 m.p.s.

β-stage.

The gradient in the static state is −7.11 mm/100 m.
The gradient in the convection state is −7.40 mm/100 m.
The height is 17.28 × 100 meters.
$(B_0 - B)_\beta$ = (7.40−7.11) × 17.28 = 0.29 × 17.28 = 5.01 mm.
$(B_0 - B)_\alpha$ = (8.46−8.24) × 10.78 = 0.22 × 10.78 = 2.37 mm.

$(B_0 - B)$ = total change in the pressure ...... 7.38 mm.
T = temperature at the top of the β-stage 273°
B = pressure at the top of the β-stage 544 mm.
w_β by the formula .... 46.11 m.p.s.

It is seen from the preceding computation that we have found a vertical velocity of

w_α = 23.91 meters per second at the top of the α-stage, and
w_β = 46.11 meters per second at the top of the β-stage.
w_δ = small. The velocity is evidently small at the top of the cloud.

There are, however, a number of reasons for thinking that these large values of w are erroneous, and must be greatly diminished. Since the discussion may be of interest, altho no satisfactory decision is reached as the result of it, the following circumstances should be considered.

(1) The pressures as computed for the cloud levels have been directly compared with the static pressures as determined from the gradients derived from the Barometry Report, and therefore any error in either of these steps must be allowed for in the comparison. It is noted that while there are no obvious errors in the work, we are yet dealing with small quantities,

$$(B_0 - B)_\alpha = 2.37 \text{ mm.} = 0.093 \text{ inch, and}$$
$$(B_0 - B)_\beta = 5.01 \text{ mm.} = 0.197 \text{ inch,}$$

and that it will require great precision in the meteorological data to make these figures perfectly reliable.

(2) It has been practically assumed that these two types of pressure are in action simultaneously on the same plane *within* the cloud itself. As a matter of fact the congestive circulations producing a cumulo-nimbus cloud are very complex, and they involve masses of air outside the cloud limit.

In the case of the Cottage City waterspout the cold air of the anticyclone flows over the ocean strata, and immediately sets up a series of currents of which the cloud itself is one effect. This indicates that the normal static pressure has already been disturbed, and, therefore, the vertical current begins to move before such wide variations in $(B_0 - B)$ as 2.37 or 5.11 mm. can occur. In fact the current tends to fill up the pressure difference as soon as it begins to diverge from the normal state, and if it were possible to trace this variation exactly, or if, conversely, we could accurately measure the

velocity at the several points, then the problem could be finally resolved. Unfortunately neither of these measurements can be made and therefore we are limited to general discussions. It is my impression, however, that these facts indicate that the pressure difference will seldom be as large as 1 millimeter or 0.040 inch, which implies a vertical velocity of only 15 meters per second. *There are reasons for thinking that this is the maximum value of the vertical velocity, and that it seldom can occur in nature.* Probably the vertical velocity is usually something like 5 meters per second or even less, in the midst of such a cloud, but this is merely an opinion.

(3) It is very probable that the vertical velocity increases to a maximum within the cloud at about the level of the top of the β-stage, and that it is small at the top of the cloud, also at the sea level except in the midst of the vortex. The appearance of the cloud, as usually observed, shows that there is a rapid vertical growth in the central mass from the base upward, and that a sort of boiling with overflow to the sides takes place, except as disturbed by penetrating into other moving strata. Since several theories of hail formation depend upon a very strong vertical current, it has been important to point out the fact that the *vertical velocity does not probably exceed 15 meters per second*, and that evidence implies that this is generally too high. We will consider briefly the theories proposed for the formation of large hailstones, and then make such suggestions as seem warranted by the conditions determined in this special cloud.

APPROXIMATE POSITION OF THE ISOTHERMS AND ISOBARS IN THE COTTAGE CITY WATERSPOUT CLOUD.

The practical difficulty of solving this problem lies in the fact that the data are wanting with which to compute the value of ΔB in the formula,

$$w^2 = 574.06 \frac{T}{B} \Delta B.$$

It is important to approach the true value at least approximately, if possible, and for that purpose I have made the following trial computations, shown in Table 67. The data for the B, t, $R.H.$ as selected for the three hours, 4 p. m., 1 p. m., and 10 a. m., are indicated in English measures, and transformed into metric measures. The mean temperatures, θ, of the air column in the α, β, γ, δ stages are determined as follows: Plot the values of t, 58°, 67.5° and 65° on the sea level; compute from the gradients of Table 51, summary of data, the heights at which 58° and 65° occur over the 1 p. m. and 10 a. m. columns, and draw the isotherms; plot the temperature 48.7° at the height of the bottom of the β-stage, 32° at bottom and top of the γ-stage, and 10.4° at top of the cloud, as indicated on fig. 39. Then, I have drawn the isothermal slopes by judgment, admitting that they may need modification to be true to nature, tho there is no criterion now available. The temperature was determined at each 500-foot level in the three columns, and for the intermediate 250-foot points by taking the means of successive pairs of values. This gives 6 pairs in the α-stage, 12 in the β-stage, and 13 in the δ-stage. The mean of the several α, β, γ, δ groups gives the values of θ for the several stages as shown in Table 67. The values of the vapor tension, e, were computed, taking the relative humidity, $R. H.$, given for the α-stage, and 100 per cent in the other stages. They may not be exactly correct, but they are sufficient for a close barometric reduction by the formula,

$$\log B = \log B_{\circ} - m + \beta m + \gamma m,$$

the γm term being negligible in the latitude of Cottage City.

For the purpose of comparing the resulting pressures for the several stages found by the static formula just given and those found by the thermodynamic formulas as given in Table 51, summary of data, we select for 1 p. m. the following figures:

Stages.	Static method.	Thermodynamic method.
	mm.	mm.
B_δ (top)	414.56	414.50
B_γ	539.02	539.00
B_β	544.02	544.00
B_α	672.30	672.00
B_α (bottom)	763.27	763.27

This shows that these two groups of formulas and the dependent tables work together in entire harmony, considering the very different ways of using the temperature terms, since they are involved by means of their diverse functions. The resulting isobars for the stages are indicated on fig. 39, assumed approximate position of the isotherms and isobars. It is noted that from the beginning to the end of the disturbance, from 10 a. m. to 4 p. m., the isobars in the cloud region change by about 1 mm. of mercury. In the immediate neighborhood of the waterspout, 1 p. m., there may have been a series of abrupt rises and falls of the pressure, such as are usually found on the barograph traces in thunderstorms; the extent of these I can not determine for this case, but the important fact is that the range of ΔB must have been about 1 mm. in the cloud, because it is hardly probable that it should have exceeded for any short interval the total change between the 10 a. m. and 4 p. m. extremes. By entering 1 mm. in the formula, we find

$$w = 15.52 \text{ meters per second.}$$

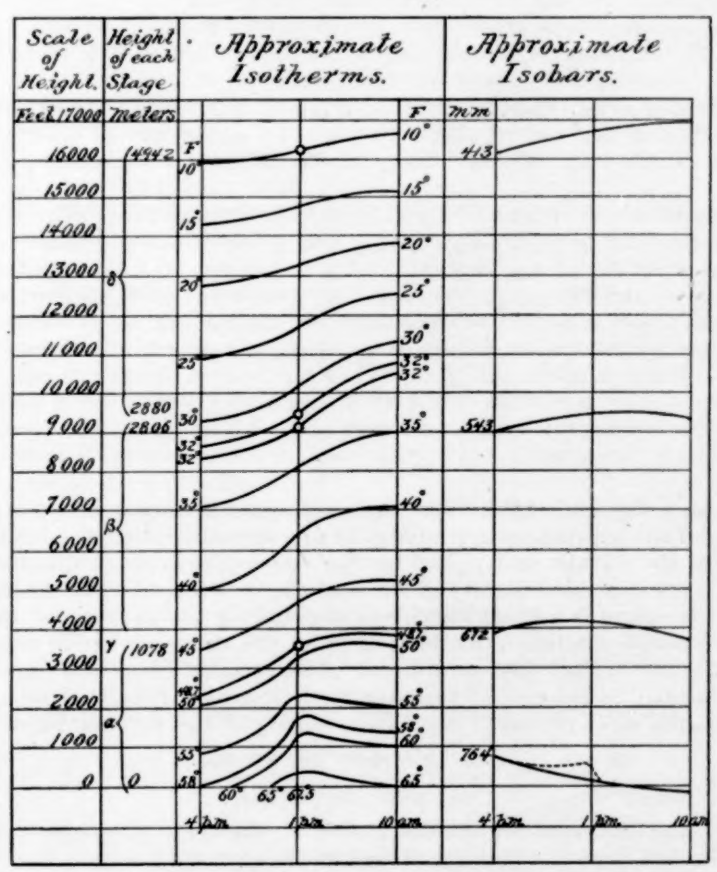

FIG. 39.—Approximate position of isotherms and isobars.

This agrees with my previous estimate of the vertical velocity. It is evident that in the other computation, where the mean gradient for the month was used, as derived from the Barometry Report, namely, −8.24 for the α-stage and −7.11 for the β-stage, Table 51, we assumed that the conditions for the waterspout were the same as those of the mean of August

TABLE 67.—*Computation of the isobars at three hours, August 19, 1896.*

4 p. m.		1 p. m.		10 a. m.	
B=30.10	=764.54 mm.	B=30.05	=763.27 mm.	B=30.03	=762.76 mm.
t=58.0°	= 14.44 C.	t=67.5°	= 19.72 C.	t=65.0°	= 18.33 C.
$R. H.$=60%	e= 7.33 mm.	$R. H.$=64%	e= 10.92 mm.	$R. H.$=67%	e= 10.49 mm.
θ_α =51.4 F.	=10.78 C.	θ_α =58.8 F.	=14.89 C.	θ_α =57.0 F.	=13.89 C.
θ_β =36.7 F.	= 2.61 C.	θ_β =39.9 F.	= 4.39 C.	θ_β =41.7 F.	= 5.39 C.
θ_δ =19.5 F.	=−6.94 C.	θ_δ =21.5 F.	=−5.83 C.	θ_δ =23.9 F.	=−4.50 C.
(α) H= 1078	log B_0=2.88340	H= 1078	log B_0=2.88268	H= 1078	log B_0=2.88239
θ=10.78	m =− .05625	θ=14.89	m =− .05546	θ=13.89	m =− .05561
e= 7.33	βm =+ 18	e=10.92	βm =+ 28	e=10.49	βm =+ 26
	log B=2.82733		log B=2.82750		log B=2.82704
	B= 671.94		B= 672.30		B= 671.49
(β) H= 1728	log B_0=2.82733	H= 1728	log B_0=2.82750	H= 1728	log B_0=2.82704
θ= 2.61	m = − .09286	θ= 4.39	m = − .09226	θ= 5.39	m = − .09193
t= 7.22	βm= + 32	t= 9.44	βm = + 38	t=10.17	βm = + 39
e= 7.58		e= 8.80		e= 9.24	
	log B =2.73479		log B =2.73562		log B =2.73550
	B= 542.99		B= 544.02		B= 543.88
(γ) H=74	ΔB= − 5.00		ΔB= − 5.00		ΔB= − 5.00
	B= 537.99		B= 539.02		B= 538.88
(δ) H =2062	log B_0=2.73077	H=2062	log B_0 =2.73161	H=2062	log B_0 =2.73149
θ=−6.94	m = − .11477	θ=5.83	m = − .11430	θ=−4.50	m = − .11373
e=4.57	βm = + 28	e=4.57	βm = + 28	e=4.57	βm = + 28
	log B=2.61628		log B=2.61759		log B=2.61804
	B= 413.31		B= 414.56		B= 414.99

taken day and night. But the waterspout occurred at midday, and the gradient was probably nearer the adiabatic rate, −8.46 for the α-stage and −7.40 for the β-stage, than was supposed. The practical difficulty of successfully treating this part of the discussion is a great barrier to concluding the analysis of the dynamic conditions as derived from the thermodynamic state of the cloud, and additional observational data are much needed under similar thunderstorm actions. Finally, I adopt as the most probable maximum velocity of the vertical current

$$w = 15 \text{ meters per second.}$$

THE BUILDING OF HAIL.

The literature of the discussion of the many problems connected with the making of hailstones in the air is very extensive, but the following references are sufficient to place the subject before the reader in its most recent phases:

Recent Advances in Meteorology, William Ferrel. Appendix 71, Annual Report of the Chief Signal Officer for 1885, Part 2. Pp. 302–315.

Lehrbuch der Meteorologie, J. Hann. 1901. Pp. 682–699.

Die Bildung des Hagels, Wilh. Trabert. Meteorol. Zeitschr., October, 1899. Pp. 433–447.

Beiträge zur Hageltheorie, P. Schreiber. Meteorol. Zeitschr., February, 1901. Pp. 58–70.

Hailstones, F. W. Very. Transactions of the Academy of Science and Art, Pittsburg; lecture January 5, 1904.

Doctor Trabert's paper contains many references to other papers on hail.

The physical structure of hailstones is about as follows:

1. *Central nucleus of opaque snow or snowy ice,* consisting of snowflakes and ice crystals mixed with air bubbles from 0.1 to 0.5 inch in diameter.

2. *Layer of clear ice,* or pellucid material containing incisted air cells and liquid in radiating inclosures. It is 0.1 to 0.2 inch thick and terminates in a sharply defined spherical boundary, or else in a more irregular boundary to which adhere mammillary masses of soft snow, which may be 0.1 inch in thickness. The clear layer itself is built up of a collection of many small drops, which are instantly stiffened, as in *undercooled water,* which is 5° to 10° below the freezing temperature, when water falls below zero without freezing and then sets with a shock. The ice crystals are mixed in a motley array.

3. *A series of opaque and clear layers succeed each other,* as

many as fourteen having been counted, the last layer usually being opaque and adhering to a very thin layer of clear ice.

The diameters of hailstones vary from 0.5 inch to 4 inches; a frequent size is 1 inch to 2 inches. The shapes of hailstones may be divided into two classes: (1) Those which have a thick base and pointed top, such as conical with a flat base, pyramidal with a round base, pear shape with a concave base, and mushroom shape with the table downward. In these the accretions are chiefly on the lower side of the body, as if gained in falling thru layers of snow and water drops to the ground. (2) Those which are regularly disposed about a center, as if they grew regularly from all sides, and are spherical, ellipsoidal, lensform and hemispherical, the ellipsoidal being most common. The stones frequently indicate some effects as from a rotary motion about an axis, so that they grow in a certain plane more readily than in other places. The clear ice forms chiefly on the large plane like a tooth-shaped disk, the forms being many and irregular, depending on the accumulation of hexagonal ice crystals.

The order of construction from the center outward, if there were no repetition of the layers, would probably be:

1. Center = snow belonging to the δ-stage in the cloud.
2. Snow and ice mixed = the undercooled crystals of the γ-stage.
3. Clear ice = the gradual cooling ice of the β-stage in contact with a cold nucleus.

If there are repetitions, it follows that these stages are mixt in the internal circulation of the cloud, and that they are brought in contact with the nucleus in succession by falling, or by some other mechanical process. The undercooling of the γ-stage and δ-stage must be due to sudden transitions of the stone from one layer to another having different temperatures. The gradual cooling must be due to the contact of saturated water drops in the β-stage with the nucleus which has passed out of the δ-stage and the γ-stage into the β-stage. The irregularities merely record the congested state of the air and a mixt condition of the δ-γ-β-stages.

Hailstones are usually of about one kind in the same storm, but they change their type from storm to storm. Hail is formed at the rear of the rising column of warm air, at the place of marked changes in the isotherms, when the barometer is beginning to rise rapidly and the wind shifts from the south to the northwest. *This is the locus of the contact of two counter currents of air having very different temperatures, and hail formation is one of the results of the rapid progress of the warm and cold layers toward thermal equilibrium.* The energy difference, which marks the departure from the normal equilibrium, does not lie in a vertical direction so much as in a horizontal direction. There is a rapid rise of warm air with condensation of the vapor, as in a thunderstorm, and the lightning usually occurs at about the time of hailfall, but it is sometimes earlier and at other times later, and not necessarily simultaneous. On mountains it is said that there is always lightning with hail and in the valleys sometimes lightning with hail. On mountains there are observed to occur simultaneously lightning, undercooled drops, and snow crystals. In falling thru the warm α-stage the outer opaque coating of the hailstone becomes covered with liquid water and in this condition the stone falls to the ground.

THEORIES OF THE FORMATION OF HAILSTONES.

There are many theories regarding the mode of formation of hailstones, in each of which there is probably an element of truth. None of them can be said to be entirely satisfactory, and yet it is very likely that nearly all of the assigned natural causes and effects generally operate in producing the phenomena. The two principal facts to be accounted for are, (1) the presence of the cold which causes the sudden stiffening of the water drop at undercooled temperatures, and (2) the alternation of snow and water materials in the successive layers. In the sudden cooling of the water drops there is evolved a considerable amount of latent heat, and the cold must be present to such an extent as to overcome the restraining effect of this latent heat, and yet produce cooling as by a shock of the molecular material in the water. The theories may be briefly summarized as follows:

1. *The oscillation theory.*—It is assumed that two cloud layers of different temperatures are superposed, and that a hailstone oscillates up and down between them under an electrical attraction and repulsion, one cloud being charged with negative electricity, and the other with positive electricity. This theory is now considered unnatural and arbitrary, and it certainly is not true, because no electrical forces exist in clouds capable of thus moving heavy stones up and down in the presence of gravity.

2. *The orbital theory.*—Professor Ferrel postulated a vertical orbit in the cloud, in connection with an internal vortex tube having a vertical axis, and supposed that the stones past around this thru considerable changes in altitude, and thru masses of different structure. Such a flow of air inside the cloud is very improbable, and there is no evidence that the cloud thus rotates. A modification of this view is found in the horizontal roll which very frequently exists on the back side of the warm ascending current, at the place of the most active mixing with the cold column. It is very likely that this does often develop in thunderstorm clouds, and indeed, there may be several such rolls on horizontal axes, and their action may well produce certain effects upon the construction of hailstones of different types; the effects are confined to merely differential variations of the typical structures. The vertical component can hardly lift the stones, except those of the smaller sizes. If the upward current on one side retards a freely falling stone, on the other side of the roll it would accelerate its fall, and so discharge it from the local action in the cloud by this impulse.

3. *The upward current theory.*—The sustaining force of a strong upward current of air in the midst of the cloud, whereby a hailstone is held aloft for a considerable time while it receives accretions from the contents of the ascending stream, acting especially on the under side, is, doubtless, the most important theory to be examined. The growth on the underside of a hailstone can be accounted for either by falling from a considerable height thru the cloud, or by being sustained at a given height by an upward flowing current. There are several difficulties if not objections to this theory, when taken as the single cause of the formation.

(1) The condensation products carried in the vertical current do not seem sufficient to produce the largest stones.

Let W = grams of water in 1 cu. meter.

$\frac{W}{10^6}$ = grams of water in 1 cu. centimeter.

A stone of section πr^2 falling thru a height dh will gain $\frac{W}{10^6} \cdot \pi r^2 \cdot dh$ grams, which is equal to a volume increase of $4\pi r^2 \cdot dr$. Hence, $dr = \frac{W}{4\times 10^6} dh$, and $r_2 - r_1 = \frac{W}{4\ 000\ 000} \times (h_2 - h_1)$. If the height of fall is 2 kilometers (200,000 cm.), and $W = 4$ grams, at freezing temperatures, then $\Delta r = 0.2$ cm. = 2 mm. This is Trabert's argument, and he thinks it does not fully account for the large stones which are found weighing as much as 250 to 1000 grams. This view conceives the stones to form in the δ and γ-stage as ordinarily stratified in a quiet cloud, but I think that suitable modification can be indicated, which will to some extent avoid the difficulty.

(2) The stream lines around the stone will doubtless carry off some of the particles of water without their touching the

stone itself, and this will tend to diminish the quantity that is actually deposited, thus strengthening the former objection that the total quantity of deposit is insufficient to produce the mass of the observed hailstones.

(3) It is not easy to account for the concentric layers on the upward current theory, or the downward fall theory in a simple cloud.

(4) In seeking to maintain this current theory of accretion, Professor Schreiber, it seems to me, has assumed excessive heights and improbable velocities in the ascending currents. Thus, he makes two assumptions: (*a*) that the vertical velocity increases steadily, at the rate of 3 meters per second per 1000 meters of altitude, as in the second column of the following table; (*b*) that the vertical velocity increases at the rate of 7.5 meters per second per 1000 meters, up to 20,000 meters of altitude, and then diminishes at the same rate, down to 0 at 40,000 meters, as in the third column of the following table.

Schreiber's assumed vertical velocities.

Height in meters.	(*a*)	(*b*)
	m. p. s.	*m. p. s.*
30000	90	75
20000	60	150
10000	30	75
5000	15	37.5
4000	12	30.0
3000	9	22.5
2000	6	15.0
1000	3	7.5
0	0	0

He makes two other assumptions for trial, (1) that the vertical current has no limit in height, and the same velocity and density thruout, and (2) that the velocity is the same thruout, but that the density diminishes with the height. He discusses the sorting velocities which separate the stones of different diameters, those larger than the critical velocity falling to the ground, and those smaller rising in the current and growing to larger size in preparation for a fall. It may be remarked, generally, that cloud heights above 10,000 meters are rarely measured, and that the vertical velocities are a maximum within the cloud, probably at the height of the γ-stage, rather than at the top, somewhat as assumed in his fourth trial (p. 62), but by no means at such large values of the current. Schreiber asserts that hail forms at the top of such lofty clouds as 30,000 meters and in vertical currents of 100 meters per second, which it seems to me is impossible in view of the fact that such clouds do not exist, and that by adiabatic laws the γ-stage is seldom higher than 6000 meters in the most favorable summer conditions. In this connection refer to my discussion of the heights of the several stages, Cloud Report, Annual Report Weather Bureau, 1898–1899, pages 720–723, and chart 74. There can be little doubt that we must confine the formation of hail to the region 3000–7000 meters above the ground, and usually to the middle height, most frequently near the 5000-meter level. It is noted that Schreiber assigns a vertical velocity of 15 m. p. s. at the 5000-meter level, and that this agrees with the maximum vertical velocity which it seems probable can be developed in an ordinary summer cloud. This is not strong enough to sustain a hailstone of 1 cm. diameter, which is a small specimen, as a velocity of 20 m. p. s. is required for that purpose, while 40 m. p. s. is required to sustain a large stone 4 cm. in diameter.

4. *The electrical attraction theory.*—In order to escape from such difficulties as those just enumerated in the vertical current theory, Trabert advocates the theory that the sudden accumulation of drops on the nucleus at undercooled temperatures is due to the electrical charging of the nuclei at the instant of a lightning flash, the surface charges having the power to attract water drops to the charged surface. The drops of a jet of water are thus suddenly drawn together by an electrified piece of wax placed near it. The drops fly together when changes take place in the electric field surrounding them. Some observers say that there is no hail without the electric phenomena. Each layer of ice is made suddenly by electric impulses which follow in succession for the several layers. The deposit of a layer brings the undercooled temperature up to the freezing point. The escaping heat of the undercooled mass in condensing makes a water layer on the outside which changes to ice. There is a considerable quantity of latent heat evolved in the process of water and ice formation. Hail weather and lightning weather are alike in kind and different in intensity. Thunderstorms are associated with the horizontal roll due to overturning, and hailstones with the vertical vortex due to excessive convection currents. It has been suggested that the heat of the convection process is transformed into electricity and that the required cooling is produced in that way, but of this there is little evidence. The cooling is also referred to sudden expansion in the air, but this would produce so great changes in the barometer that it would be readily detected.

This electrical theory ought to play a part in the formation of hail at times, but it is hardly demonstrable that hail does not fall without lightning, and certainly it is not shown that a flash of lightning occurs at the time of the deposit of the several stratified layers. A hailstorm often lasts many minutes, and during that time there must be, on this theory, such an incessant recurrence of lightning to match the numerous layers of ice that it would be a very conspicuous event. There are many instances known in which the lightning seems to have really followed the hail by many seconds, but it should evidently precede it, if the time allowance for the fall from the cloud to the ground is subtracted from the instant when the hail is seen to fall upon the ground. F. W. Very writes:

> Severe hailstorms are almost universally accompanied by thunder and lightning, but the electrical display is apt to lag, and even to attain its greatest development as the storm advances to its close.

The rising air carries up the low surface potential on the front side of the hail squall, and the descending air brings down the high potential of the upper levels, so that there is an increase in the difference of potential at the hail level which causes horizontal flashes in the cloud, for the greater part. The earth's negative charge is carried aloft to the hailstones, which are often negatively charged. Snow which forms in the high levels is usually positively charged. Reversals of the ordinary disposition of the electric potential have been noted as the effect of snow, hail, and water inductions brought to the surface of the ground.

5. *The stratification theory.*—After the foregoing examination of the theories that have been heretofore proposed for the explanation of the growth of hailstones, I proceed to examine the subject from a new point of view, which seems to me to offer certain advantages over the other theories, and to embody the best points of them all. This I call the stratification theory. It happens that a hailstorm cloud, which is merely an intense form of thunderstorm cloud, really consists of two component portions separated from each other by isothermal surfaces inclined forward from the vertical. On the front side the air is much warmer than on the back side, and along the line of separation the contour is strongly stratified by the mutual interpenetration from opposite directions of layers having different temperatures.

Fig. 40, "Stratification of the β and δ-stages in a thunderstorm cloud with hail", roughly illustrates the idea. Such storms begin in consequence of the transportation of cold air into a region of warm air, and in many cases the difference of temperature amounts to as much as 20° F. The tendency for

such masses of air at different temperatures is to mix intimately and irregularly in order to restore the thermal equilibrium as rapidly as possible. The cold air is carried forward in the high levels, and like a sheet overflows the warmer lower layers, as is indicated by the first formation of clouds of the cirrus type, which later change into alto-cumulus and alto-stratus types.

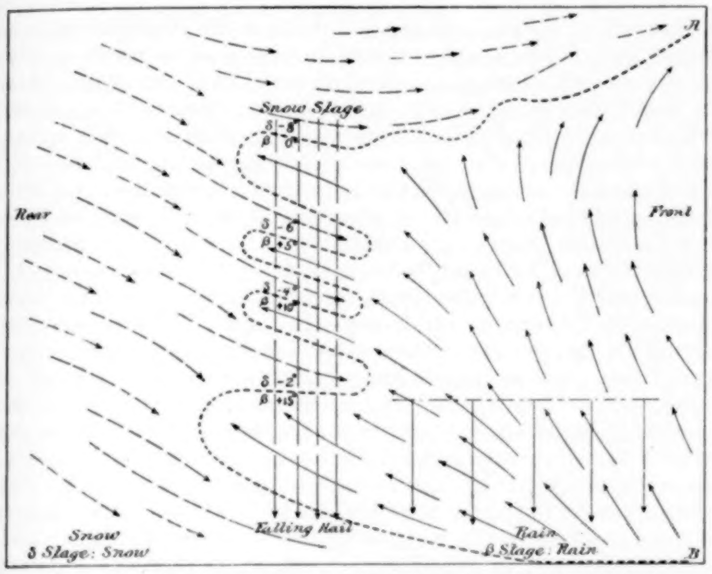

FIG. 40.—Stratification of β- and δ-stage in a cloud with hail.

The body of warm air tends to rise and interpenetrate the cold air in a congested circulation including numerous minor whirls and small vortices. On the western side of the column of rising warm air the tendency to stratification of the warm and cold layers in horizontal directions is very pronounced, the sheets of different temperatures penetrating strongly at a series of intervals in elevation, so that they lie over each other on a given vertical in succession which may be repeated many times. The boundary between the β-stage and the δ-stage, or the course of the γ-stage, is therefore folded upon itself several times in a vertical direction.

For example we may suppose that the temperatures are arranged in some such manner as the following:

Let $\beta = +15°$ C. and $\delta = -2°$ C. in the lowest fold;
let $\beta = +10°$ C. and $\delta = -4°$ C. in the second fold;
let $\beta = +5°$ C. and $\delta = -6°$ C. in the third fold;
let $\beta = +0°$ C. and $\delta = -8°$ C. in the fourth fold;

The temperatures in the β-stage fall off more rapidly than in the δ-stage, and the difference between them diminishes with the height.

The snow nucleus, starting from a great height, meets the water carried aloft in the warm strata, is coated with the drops, which are chilled by its lower temperature and frozen in irregular semicrystaline forms. The vertical current at even moderate velocities is able to carry up all the water contents in the form of drops, and they are injected as it were sideways from a fountain into the higher strata. The snow nucleus is therefore simply exposed to a spray of water drops, brought from the lower strata where high vapor contents prevail, because of the warm air occupying the lower levels before they were disturbed by the overflowing anticyclonic cold. The cold nucleus, therefore, suddenly condenses a layer of clear ice, or ice and snow when mixt by the minor vortices and horizontal rolling of the air. The small hailstone then falls by gravity thru successive stratifications of the snow and rain stages, it grows on the underside by special accumulations there, and finally reaches the ground, having received as many layers as there are distinct horizontal minor stratifications. The undercooling takes place chiefly in the highest stratifications, and ice or snow crystals are found deposited in the inner layers of the hailstone. The under cooling diminishes with the descent so that the outer layers are watery or simply opaque.

There evidently exists a series of small horizontal rolls produced by the dynamic action of the interflowing sheets, where the mixture of air at different temperatures is facilitated by drawing it out into thin ribbons, as in ordinary cyclonic circulations. The lowest cold stratum flows forward on the ground, producing the squall of cold air that precedes the rainfall. An examination of the isotherms and isobars on fig. 39 shows that this distribution of the air currents is the probable one, allowing for the minor configurations on the edges of the mixing masses. The isobars show that at the sea level the air flows forward, but in the upper levels it flows backward at the time of the hailstorm. The isotherms show that there is an excess of upward velocity at the line of separation, and also that the flow is backward in the higher levels. The production of lightning discharges under these conditions, especially in the region where the cloud is serrated as to temperatures, is evidently to be anticipated, in consequence of the rapid changes occurring in the thermal conditions and the water contents. The hailstones may therefore be heavily charged with positive electricity, or even with negative electricity, under these circumstances, and the fallen hailstones may exhibit electrical states by no means uniform from storm to storm.

It is desirable that numerous computations be made on the data that may be obtained from the surface observations in thunderstorms and in hailstorms, with the view of transforming our inferences regarding the thermal operations going on in the midst of such clouds into more definite knowledge. The formulas and the tables employed in this paper are satisfactory, and it is possible to accomplish much by using only our surface observations. It is, however, very important to supplement such studies with the actual observations in the clouds by balloons and kites.

CLIMATOLOGICAL REPORTS FROM THE PHILIPPINES.

The storm warnings, the publications, and other works that issue from the Philippine Weather Bureau show what an intense intellectual activity can be kept up by white men in a climate that is ordinarily supposed to be conducive to sluggishness and degeneracy. We never hear that the officials of the Manila Observatory need to leave their station occasionally in order to renew their mental and bodily vigor. They have been working on at the same rate for forty years past, and the great publications that they have lately issued seem to be due simply to the fact that more money has been put at their disposal for that purpose. The latest volume contains the complete record of two, four, or six observations daily of every ordinary meteorological element, in the year 1903, at forty-four stations, between the latitudes 6° 33′ and 20° 28′ N. and between the longitudes 119° 53′ and 126° 32′ E. All but one of these stations are near sea level, but that one, Baguio, is at 1456 meters elevation. Classified by orders we have: I, 7; II, 10; III, 20; IV, 7. With two exceptions, the observers seem to be Spaniards, and possibly members of the Jesuit order. The publications conform almost exactly to the requirements of the International Meteorological Committee. At the first and second class stations the hours of observation are 2, 6, and 10 a. m., 2, 6, and 10 p. m.; at the third and fourth class stations the hours are 6 a. m. and 2 p. m. At most stations the maximum and minimum temperatures are observed. The barometer readings are reduced to sea level, but the reduction to standard gravity seems to have been omitted, notwithstanding the advice of the International Committee and the general usage

of modern climatologists. A uniform standard of time is used, namely, that of eight hours east of Greenwich, which is, we believe, also the time shown by the time ball at the observatory for the use of the shipping. 8 a. m. at Washington is simultaneous with 9 p. m. of the same date at Manila. The record for a single month, at all 44 stations, occupies about 93 or 94 pages, and the twelve months, without an annual summary, make up an imposing volume of 1128 pages, from which one may see that the pages are not crowded with figures. This suggests the remark that considerable extravagance with regard to space and pages is shown in nearly all tabular matter that has hitherto been published under American auspices. We notice that in corresponding publications by European nations twice as much material is crowded into a single quarto page without destroying, but in fact increasing, the convenience with which one uses the data. Still it must be confest that very few nations have made their original daily records so accessible to climatologists as these of the Philippines, and we believe the result will be greatly to the advantage of these islands, since the superior attractiveness of their climates can now be more fully appreciated.

With this volume we receive also a copy of the Far Eastern Review, Vol. II, No. 13, for May, 1906, which is especially devoted to the Moro Province and the island of Mindanao. We owe this to the kindness of our former colleague, now Capt. John P. Finley, U. S. A., Governor of the District of Zamboanga and founder of the Moro Exchange at that place. As many of our readers are teachers of geography and climatology and will wish to do justice to these distant American possessions, we must refer them to this Far Eastern Review for details as to the climate and country. Brentano's (incorp.) is the American agency.

LUNAR RAINBOW AT TAMPA, FLA.

By J. S. HAZEN, Local Forecaster. Dated October 30, 1906.

A peculiar and interesting meteorological condition prevailed over this vicinity during the passage of a West Indian storm over the Gulf on October 1, 2, and 3. On October 1, from 8:30 to 10:30 p. m., fully eight-tenths of the sky was covered by a striated form of cirro-cumulus clouds, making a uniform banded appearance which was very striking. The appearance was much like the segments of a gigantic orange over portions of the sky. The bands were apparently about 10° in width at the zenith, decreasing somewhat toward the horizon, and were well defined and distinct from the intermediate spaces, which were apparently clear of clouds and of about the same width.

About 9 p. m. a brilliant and perfect lunar corona was observed, the prismatic colors being especially well defined, and running from purple to pale lavender. There was also a double row of concentric rings showing prismatic colors, outside the first corona. On the 2d and 3d of October lunar rainbows were observed, that on the 2d being especially brilliant and an object of much interest to many people in Tampa who saw it. A slight thunderstorm past west of the station early in the evening, and rapidly moving, massive cumulus clouds were drifting across the sky near the western horizon during the time the bow was noted.

The bow was a perfect arch, and showed all prismatic colors with remarkable distinctness. It reached at one time high above a large mass of cumulus clouds, showing with equal distinctness against the back ground of dark cumulus clouds and the apparently clear sky above the cloud. Stars could be seen thru the bow with brilliancy very little diminished, if any. Both phenomena were observed by many in this city. It is understood that a lunar rainbow was observed in Pensacola also about this time.

The lunar rainbow is such an unusual occurrence that the writer would be pleased to have editorial comment pertaining to meteorological conditions necessary for the display of such phenomena, and whether or not the passage of a West Indian storm would bring about meteorological conditions likely to result in such phenomena.

It occurs to the writer that certain extensive movements of the upper air must be necessary to result in such a condition as was observed here on the dates mentioned.

EDITORIAL.—On the evening of October 1 the above-mentioned storm center was two or three hundred miles northwest of Tampa, and whatever the local winds may have been at that place the general drift of the atmosphere above it seems to have been from the south and east. This upper current was not necessarily at any great elevation, and below it was the usual layer, a few thousand feet in thickness, of relatively quiet air. Under these conditions a series of atmospheric waves, each of them many miles in length and possibly a mile or two in breadth, is usually formed.[1] The upper portion, or crest, of each billow becomes visible by a little cloudy condensation, while the lower portion is formed of relatively clear air. These crests and troughs must have extended eastward and westward in this case, or perhaps northeastward and southwestward, over Tampa, in parallel lines toward the distant horizon, and the observer, looking upward, should have seen them by perspective tapering toward the two opposite vanishing points, and covering the sky with markings analogous to the gores of a gigantic balloon. The width of each gore, or band, is stated by Mr. Hazen to have been about ten degrees at the zenith, and if the clouds were five or six thousand feet above him, this would correspond to about one thousand feet in linear distance.[2] If we knew the exact height and width of the billows, we could compute approximately the velocity of the wind at that elevation.

A corona, or glory, is formed by light shining thru a layer of small particles, such as dust, or fog, or crystals (spiculæ) of ice. If the observer had given the diameters of some of the rings of color composing the corona, something could have been inferred about the size and shape of these particles; but the fact that he does not mention the size, nor state whether the purple rings were inside or outside of the lavender rings makes it difficult to decide whether we have to do with a corona or a halo.

On the 2d and 3d of October lunar rainbows were observed. These require the presence of drops of water of appreciable size, and are not especially rare, but it is interesting to notice that they occurred apparently long after the passage of a slight thunderstorm on the 2d, and again quite independently of any rain on the 3d. The drops needed to form the lunar rainbows must, therefore, have been thinly scattered thru the clear air and may have evaporated in falling to the ground.

The passage of a West Indian hurricane is believed not to be necessary as preliminary to the appearance of such rainbows and coronas, and we hope that several of the observers in Florida will give us statistical studies of the relations between storms and halos, coronas and rainbows, based upon the records of their respective stations.—*C. A.*

THE ORIGIN OF OUR COLD WAVES.

It has for a long time been desirable to obtain observations and daily maps that would throw light upon the rival hypotheses as to the origin and nature, or the mechanics, of the areas of high pressure and cold, dry air that descend from the northwest, north, and sometimes the northeast upon the United States.

According to one, these are due to upper westerly winds blowing over the Rocky Mountains toward areas of low pressure. The air becomes clear and dry as it descends the eastern

[1] See Helmholtz on "Atmospheric Motions," translated in "Mechanics of the Earth's Atmosphere."

[2] One degree is 1/57.3 part of the radius.

slope, and cools by radiation faster than it warms up by compression and insolation.

According to another, these are horizontal protrusions southward from the great areas of cold air lying close to the ground in Arctic America. It is supposed that only a very thin lower layer is drawn southward by the development of areas of low pressure in Tropical America, the Gulf States, and the West Indies.

According to a third theory, there is a cold upper anti-trade flowing from equatorial regions to the Arctic on a gradient so gentle that its clear air cools to the lowest temperatures—so low that, when it finally descends in latitudes 50° to 70°, its warming by compression does not raise its temperature above the —50° or —30° that is observed in our severest cold waves.

It may well be that all three of these views must be combined together in order to explain the actual processes of nature. Doubtless we shall need to obtain more data from the upper air by means of kites and balloons, but meanwhile Prof. R. F. Stupart has directed attention toward the possibility of compiling daily weather maps extending northward beyond the Arctic Circle as being the first requisite to the successful study of the question, and we print as Charts IX–XIV of this REVIEW a series of his maps for January 13–18, 1904, as illustrating what is now possible in this line of work. There is no doubt but that steady progress will be made in filling up the blank spaces over the great frozen region of North America, and that eventually the charts will abundantly represent the conditions at the lower level of the atmosphere. But the data for upper levels will, we fear, still be rather scanty, so that for these we shall necessarily rely upon deduction rather than observation.

Even now, however, we already perceive many analogies between these North American maps and those of Europe and Asia, so that these combined with similar ocean maps represent one simple mechanical circulation. We must learn to study the whole Northern Hemisphere, or the whole globe, on a globular surface instead of on the plane surfaces that are offered by our various misleading styles of cartographic projection.—*C. A.*

METEOROLOGY IN AUSTRIA.

The Imperial Centralanstalt for Meteorology and Geodynamics published its first annual volume, or Jahrbuch, for the year 1855, and a new series began with 1863. Many of these volumes contain not merely elaborate climatological data, but additional material, sometimes published as an Anhang, or Appendix, and we make the following notes on the appendix to the volume for 1904, which was received during August, 1906.

MEAN ATMOSPHERIC PRESSURE.

The distribution of atmospheric pressure over central and southern Europe was the subject of an important memoir by Hann, published in 1887, in Volume II of Penck's Geographical Memoirs. Therein Hann mentions the difficulty of finding the stations at which the more important series of observations have been made, owing in part to frequent changes. In order to obviate this trouble Margules recommends that from time to time, if possible yearly, or at least every five years, the recent observations should be combined with the older series, thus maintaining a continual revision of the annual and monthly averages. He has, therefore, compiled the records that have accumulated since the close of Hann's work, viz, for nineteen years, 1886–1904, inclusive. In order that all may be reduced to an absolute standard of pressure he states that we must first have a station whose barometer has not changed during the whole interval, and in order to assure ourselves of this the barometers used at the central station must be compared annually with an absolutely correct barometer; but this, he says, has never been done in Austria, and we believe we may add that it has not been done elsewhere. There are in fact, so far as we know, but three institutions in the world, viz, the Central Physical Observatory at St. Petersburg, the International Bureau of Weights and Measures, at Sévres, near Paris, and the Bureau of Standards or Reichsanstalt, at Charlottenberg, near Berlin, that possess true normal barometers, so constructed that every imaginable source of error can be investigated. The barometric work done by meteorological offices thruout the world has not yet attained to a precision comparable with that attained in their own thermometric observations. Even the most accurate physicists investigating the properties of gases seem to be liable to assume the accuracy of their barometric work, while pushing the thermometric measurements to the highest refinements. The mercurial barometers used by meteorologists need careful calibration and frequent comparisons in order to enable us to detect the changes going on in their instrumental corrections.

Margules finds himself forced to assume that during these nineteen years the barometer of the Centralanstalt has remained correct and unchanged to within one-tenth of a millimeter. His first step is then to compare the annual mean pressures as observed at Vienna with the means observed at other stations near by at nearly the same level, and more especially those stations whose differences from Vienna have changed but little during the whole period. For instance, the station at Judenburg shows a departure from Vienna of −0.70 millimeters during the first seven years, −0.79 in the next five years, and −0.78 during the third lustrum. The greatest departure in the annual means was −0.95 and the least −0.63. As there was no system in these variations this is called a constant series. The distance between the two stations is 165 kilometers, and the annual means are reduced to the same elevation, 200 meters above the sea level, before comparison. On the other hand an equally important station, Kremsmuenster, at a distance of 160 kilometers, showed the following differences for the successive lustra, namely, 16.38, 16.22, 16.08 millimeters, which looks as tho there had been a steady change in one or the other barometer. Similar systematic changes are found in other cases. These differences are partly explained as dependent upon the distances between the stations, and their directions from one another, in connection with an occasional abnormal distribution of pressure. Such abnormal deviations may have continued, in one case, for three consecutive years, when large barometric depressions lay for a long time to the south of Vienna. Margules concludes that these remarks will interest only the officials of the various meteorological institutions.

The annual volumes contain too many figures, and it is impossible to properly check the computations. Therefore if anyone wishes to use these published figures he must spend much labor in selecting what is best and most appropriate from this excess of material. If this preliminary checking is to be done systematically in the central offices it would result in diminishing the quantity of printed material. He thinks that atmospheric pressure has no direct climatological interest and might properly be published to a very limited degree only. For those purposes to which monthly means of pressure do apply it would suffice to have one station in the low lands, or one high and one low station in the mountain regions, for every circle of one hundred kilometers radius. This is very nearly the same as one barometric station to a circle whose radius is one degree of a great circle, or to every four square degrees, or about two hundred for the area covered by the United States. As there are some problems in the mechanics of the atmosphere that are peculiar to the orography of the North American Continent, we think that for the present at least, until these are solved, it is fortunate that the United States is in a position to publish monthly and annual means reduced to a uniform standard for all of its 175 baro-

metric stations. Eventually, however, we shall undoubtedly be able to restrict this publication somewhat and follow out Margules: "If for certain special investigations a finer network of barometric stations is desired they certainly can be easily established, and then dissolved at the close of the work".

Hitherto the Weather Bureau has not attempted to forecast thunderstorms, hailstorms, and tornadoes, but if ever we should do this for special localities, such as our large cities, we should certainly need a much closer network of barometric stations than at present.

THUNDERSTORMS, LIGHTNING, AND HAIL.

The observations of thunderstorms and hail in upper Austria, during the year 1904, have been summarized by Prof. R. Prohaska. The total number of stations was 426, and the number of reports 17,850 thunderstorms, with 1578 additional reports of distant lightning or heat lightning. The average number of thunderstorms per station was 42.7 for the year 1904, being the highest since the series of reports began. The next highest was 37.9 in 1889; the lowest was 27.0 in 1900 and also in 1902. The regular registration of hail began in 1888; the average number of hailstorms per station during the fourteen years was 2.3; the maximum number was 3.6 for this same year, 1904. Hailstorms occur in long narrow streaks; out of 46 cases that were examined the length of the streak varied between twenty and two hundred kilometers, while the average width was from five to fifteen kilometers. The fronts of the hailstorms advanced with an average velocity of from thirty to forty-five kilometers per hour. Hailstones having large diameters occurred as follows:

Diameters—centimeters.	Frequency—days.
½	18
1	24
2	12
3	6
4	4
5	4
7	3
8	2
10	1

As ten centimeters is practically the same as four inches, the reader will see that the agriculturists of Austria probably suffer more from hail than those of the United States.

With regard to lightning strokes Prohaska states that an unusual number of strokes, viz, 807, were reported in 1904, of which 95 related to injuries to persons, 115 to domestic animals, 179 to trees, 177 to buildings set on fire by the lightning, 114 to the so-called "cold strokes", which injure, but do not set the buildings on fire, and 127 miscellaneous.

GENERAL INDEX.

Doctor Forster, librarian of the Centralanstalt, publishes a general register of the contents of the annual Jahrbucher of the Centralanstalt for the years 1864–1903. This occupies only six pages, but will be continually referred to by those who need to use the data contained in these volumes. We hope that every other national weather bureau will publish similar registers.—*C. A.*

MOUNTAIN STATIONS FOR FORECAST WORK.

The study by Mr. McLeod and Professor Barnes published on a previous page is analogous to those made by myself in my efforts to utilize the observations made on Mount Washington in daily forecast work. That station was maintained for seventeen years, and during the latter part of this period at my earnest request, since I was frequently able to forecast weather changes by means of observations telegraphed daily from the summit. Eventually, however, the station was discontinued, as the cost seemed to be not fully compensated by the value of the work. Professor Hazen condensed the records as to temperature and pressure into a series of graphic diagrams, and copies of these for the months of January, February, and March, for the years 1871–1886, were published in the MONTHLY WEATHER REVIEW for July, August, September, and October, 1891, with a few words of explanatory text on pages 171 of the July REVIEW and 250 of the October REVIEW. This was done in connection with a long discussion distributed thru various meteorological journals on the question whether the air temperature in areas of low pressure is higher or lower than in areas of high pressure, and the diagrams contributed somewhat to modify our ideas on that subject. The lag of the temperature changes in the lower strata behind those in the upper strata, which had been inferred by me from the early years of our work, does not appear so plain when we take the whole series into consideration.

In the MONTHLY WEATHER REVIEW, October, 1891, page 250, Professor Hazen says:

> As has been noted before, the most marked characteristic in the temperature curves has been their closeness at base and summit, indicating, apparently, a general effect not essentially modified by local causes. The earlier change at the summit in both cold waves and hot waves is remarkable, and does not seem to be due, as has been suggested, to the greater rapidity of the upper current which carries the warm or cold air from the west more rapidly to the summit than to the base. It will be seen that any effect of this kind would be very quickly obliterated by the motion of the air. Again, while on some accounts warm air from the earth's surface might produce such an effect, it would seem that cold air could not have this source, but must come from above.

Professor Hazen's diagrams give us not the actual temperatures, but the temperatures corrected for average diurnal range, and it is very desirable that a renewed study of these valuable data be made from Professor Barnes's point of view. This and many other studies could be carried out if the observations at summit and base were published in full, as has been done for Pikes Peak.—*C. A.*

WEATHER BUREAU MEN AS EDUCATORS.

Classes from high schools and academies have visited Weather Bureau offices, to study the instruments and equipment and receive informal instruction, as reported from the following offices:

Columbus, Ohio, November 16, 1906, a class from the South High School.

Mobile, Ala., October 12, and November 21 and 27, 1906, classes from Barton Academy.

Pensacola, Fla., October 19, 1906, scholars from High School No. 1.

Spokane, Wash., November 7, 8, 9, and 13, 1906, the physical geography class of the Spokane High School, in sections.

MONTHLY REVIEW OF THE PROGRESS OF CLIMATOLOGY THRUOUT THE WORLD.

C. FITZHUGH TALMAN, U. S. Weather Bureau.

METEOROLOGICAL STATIONS IN HAITI.

The accompanying chart, fig. 1, shows the location of all meteorological stations now in operation in Haiti. This chart has been corrected, in the manuscript, by Prof. Josef Scherer, of the Collège St. Martial, Port au Prince, whose labors in behalf of Haitian meteorology are well known to many readers of the REVIEW. All the stations shown on the chart, except one, report their observations to Professor Scherer, who publishes them regularly in his "*Bulletin mensuel de la Station Météorologique de Port au Prince, Haiti*". The elaborate observations made at the central observatory, Port au Prince, are published also in the Jahrbuch of the Centralanstalt für Meteorologie, Vienna, and in the Annales du Bureau Central Météorologique de France.

The climate of Port au Prince has been quite fully investigated by Scherer and Hann, and a large body of normals for this station now exists. (See the Anhang to the Vienna Jahrbuch for 1893; Meteorologische Zeitschrift, March, 1897,

pp. 116–119; and ibid., May, 1906, pp. 220–222.) The other stations are of comparatively recent origin; but normal monthly values of the rainfall at Port Margot, Gonaives, Ganthier, and Pétionville are published in Professor Scherer's monthly bulletin.

FIG 1.—Meteorological stations in Haiti.

As few particulars have hitherto been published concerning Professor Scherer's observatory at Port au Prince, which has long been regarded as one of the fundamental meteorological stations within the Tropics, the following inventory of its instrumental equipment is here presented, together with a photograph of the station (fig. 2).

FIG. 2.—Meteorological observatory of the Collège St. Martial, Port au Prince, Haiti.

Instruments in use with which observations are regularly made.

Atmospheric pressure: Standard barometer for comparison; barometer for observation; two Richard barographs.

Temperature: Maximum and minimum thermometers, properly sheltered; thermometers to record temperature of the ground at 40 cm. and 1000 cm. depth; actinometer, white and black bulbs; registering maximum thermometer for direct rays of the sun.

Humidity: Psychrometer (dry and wet bulb); psychrometer (aspiration); Richard's hygrograph.

Evaporation: Evaporometer (Piche, imbibition); evaporometer (Wild, free surface).

Wind: Recording anemometer, electrically controlled; Wild anemometer, electrically controlled, registering every ten minutes.

Sunshine and clouds: Direct observations at stated intervals; nephoscope; sunshine recorder.

Rainfall: Various rain gages.

Seismic phenomena: Seismograph; seismometer; microseismograph.

Tides: Mareograph.

Astronomical: Meridian circle, transit, etc., for determination of time.

The station Furcy, shown on our chart south of Port au Prince, is a mountain resort (altitude 1540 meters or 5053 feet), at which observations are made only during the summer months. These are published *in extenso* by Professor Scherer.

In 1905 an "astronomical and meteorological society" was organized in Port au Prince, whose station established in that city is independent of the central observatory of the Collège St. Martial. This new station is under the direction of Brother F. Constantine, of the Institution of St. Louis de Gonzales, which society also has a station at Turgeau, a suburb of Port au Prince, and publishes the observations of both its stations in a monthly bulletin.

CLIMATOLOGY OF LIBERIA.

Exact measurements of meteorological phenomena in Liberia have but recently begun.[1] A good description of the climate of this country, by J. Büttikofer, was published in Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Bd. 17, 1890, pp. 60–63, but this dealt only in generalities, containing no statistics in numerical form.

In a paper read before the Royal Geographical Society, and published in the Geographical Journal of August, 1905, Sir Harry Johnston reported that two English companies, in conjunction with the Government of Liberia, were endeavoring to accumulate knowledge regarding the productions and climate, and had begun to keep records of the rainfall. The same paper gave a sketch of the climate, based largely upon the author's personal experience.

The most extensive account of the climate of Liberia that has yet appeared, however, and the first so far as the present writer is aware, to include numerical data for definite stations, appears in Sir Harry Johnston's monumental work Liberia, recently published (New York: Dodd, Mead, & Co., 1906). Chapter 20, of Volume I, is entitled "Climate and Rainfall", and brings out some interesting facts on these subjects. The observations quoted were made in 1904 and 1905, and refer to temperature and rainfall.

Some of the stations record a wide range of temperature during the dry months, December, January, and February. At Sikombe temperatures of 105° and 56° F. were observed in the same month, February, 1905. The former is the highest shade temperature hitherto recorded in Liberia. The annual rainfall of the coast regions of western Liberia appears to be about 150 inches; behind the forest region, on the Mandingo plateau, it does not exceed 60 to 70 inches.

A SKETCH OF THE CLIMATE OF NEBRASKA.

Prof. George Evert Condra, of the University of Nebraska, has recently published a little volume, adapted for use in

[1] In 1878(?) two young men visited Washington on their way to Liberia, where they expected to teach in some college. They were urged to keep meteorological records and did, soon afterwards, while in Edinburgh, secure all necessary apparatus, but we never received any reports from them.—*C. A.*

schools, entitled "Geography of Nebraska".[2] Chapter 5 of this work is a sketch, in clear and simple language, of the average and typical climatic features of the State, with a rainfall chart, and a little photogravure entitled "Typical Snow Scene in Nebraska". The latter is noteworthy; pictures have been heretofore little used in climatological literature, tho their importance is generally recognized in other branches of science.

RAINFALL OF THE NETHERLANDS.

A discussion of the rainfall of the Netherlands, by A. J. Monné, recently published in instalments in Hemel en Dampkring, has been reprinted as a separate pamphlet.[3] In this work the author summarizes the results obtained at the stations of the Royal Netherlands Meteorological Institute down to 1900. The longest records extend back to 1845. Both normal and extreme values of the rainfall at the several stations are set forth in the tables, and a chart shows the average distribution of the annual fall over the kingdom for the period 1886–1900.

RAINFALL OF BELIZE.

A recent Colonial Report for British Honduras (Annual No. 455) gives the average rainfall at Belize for the twenty-two years 1883–1904 as 80.8 inches. This is slightly higher than the 12-year average given in Supan's "Verteilung des Niederschlags". The greatest annual rainfall is given as 114.12 inches in 1900; the least, 55.29 inches in 1893.

RAINFALL OF HERMSBURG, AUSTRIA.

Hermsburg, which is situated on the south side of the Krainer Schneeberg, in Carniola, enjoys the reputation of being one of the wettest spots in the North Temperate Zone. The only stations in continental Europe having a heavier rainfall lie in the mountains of Montenegro, back of the Bay of Cattaro.

Doctor Hann publishes a rainfall table for Hermsburg in the Meteorologische Zeitschrift for October, 1906, from which it appears that this station had a mean annual rainfall of 3069 mm. (120.82 inches) during the nineteen years, 1887–1905. The wettest year was 1889, with 4458 mm. (175.52 inches).

RAINFALL OF GAMBAGA, GOLD COAST COLONY.

While stations on the Guinea coast, owing to their proximity to the equator, have two wet and two dry seasons in the year, stations lying a few hundred miles inland from this coast have but one wet and one dry season. At Gambaga, in the northernmost part of the Gold Coast Colony, (approximate latitude 10° 45′ north), the distribution of rainfall in inches, thru the year 1904, as published in Colonial Reports—Annual No. 457 (London, 1905,) was as follows: January, 0.00; February, 0.00; March, 0.16; April, 1.74; May, 6.65; June, 3.19; July, 10.01; August, 7.25; September, 7.97; October, 3.09; November, 0.00; December, 0.00. Total for the year, 40.06.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

Athens. Observatoire National.
Annales. Tome 4. Athènes. 1906. 577, [2] pp. f°.

Christie, W[illiam] H[enry] M[ahoney].
Temperature of the air as determined from the observations and records of the fifteen years, 1891 to 1905, made at the Royal Observatory, Greenwich. (Reduction of Greenwich meteorological observations, Part 4.) Edinburgh. 1906. 67 pp. f°.

Cirera, R.
Notice sur l'Observatoire et sur quelques observations de l'éclipse du 30 Août 1905. (Mémoires de l'Observatoire de l'Ebre. No. 1.) Barcelone. 1906. 56 pp. f°.

Finland. Institut Météorologique Central de la Société des Sciences de Finlande.
Observations météorologiques. 1895–1896. Helsingfors. 1906. 129 pp. f°.

Great Britain. Parliament.
Statistical tables relating to the British colonies... Pt. 29, 1904. London. 1906. [22], 887 pp. f°.

Hesse. Grossherzogliches Hydrographisches Bureau.
Deutsches meteorologisches Jahrbuch für 1905. Darmstadt. 1906. 75 pp. f°.

Holm, Ragna.
Ueber die abnorm kleine Sonnenstrahlung in den Jahren 1902 und 1903... (Arkiv matem. astro. fys., Upsala. Bd. 2. No. 4.) 6 pp. 8°. [Upsala. 1905.]

Italy. R. Ufficio Centrale di Meteorologia e Geodinamica.
Annali. Serie seconda. Vol. 15. Parte 2, 1893. Roma. 1906. 365 pp. f°.
Same. Vol. 16. Parte 3, 1894. Roma. 1906. 363 pp. f°.

Pantanelli, Dante.
Oscillazioni nella composizione dell'acqua del pozzo di piazza maggiore in Modena. (Pub. R. Osserva. geofis. Modena. No. 18.) Modena. 1906. 10 pp. f°.

Paris. Observatoire Municipal de Montsouris.
Annales. Tome 5. Année 1904. 3-4 fascicule. Paris. 1904. 8°.
Same. Tome 5. Année 1905. 1-4 fascicule. Paris. 1905. 8°.

Philippine Weather Bureau.
Annual report for 1904. Parts 1 and 2. Manila. 1906. 208 pp. 4°.

Prussia. Königliches Preussisches Aeronautisches Observatorium bei Lindenberg.
Ergebnisse der Arbeiten... 1905. 1 Band. Braunschweig. 1906. xxix, 144 pp. 14 tables.

Prussia. Meteorologisches Institut.
Deutsches meteorologisches Jahrbuch für 1905. Heft 1. Berlin. 1906. 38 pp. f°.

Royal Geographical Society.
General index to the first 20 volumes of the Geographical Journal. London. 1906. [27], 629 pp. 8°.

Scharf, Edmund.
Der Hagel. Halle a S. 1906. vi, 195 pp. 12°.

Schück, A.
Zur Kenntnis der Wirbelsturme. Bahnan. (Westindien, Indischer Ozean, Süd-und Nord-Ost Pacific.) (Beiträge zur Meereskunde. III Fortsetzung.) Hamburg. 1906. Pp. 49–83. f°.

Voss, Ernst Ludwig.
Die Niederschlagsverhältnisse von Südamerika. Inaug.-diss... Rostock. Rostock. 1905. 35 pp. f°.

Württemberg. K. Württembergisches Meteorologisches Zentralstation.
Deutsches meteorologisches Jahrbuch für 1904. Stuttgart. 1906. 64 pp. f°.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Bulletin of the American Geographical Society. New York. Vol. 38. Nov., 1906.
Huntington, Ellsworth. The vale of Kashmir. [Part II.—The climate of the past. Pp. 668–682.]

Bulletin of the Geographic Society of Chicago. Chicago. No. 3. 1906.
Cox, Henry J. and Goode, J. Paul. (Ed.) Lantern slide illustrations for the teaching of meteorology. Pp. 1-130.

Journal of Geography. New York. Vol. 5. Oct., 1906.
Ward, Robert DeC[ourcy]. The characteristics of the zones. II.—The temperate zones. Pp. 337-353.

[2] Condra, George Evert. Geography of Nebraska. Lincoln, Nebr.: University Pub. Co., 1906.

[3] Monné, A. J. Neerslag in het Koninkrijk der Nederlanden. 's-Gravenhage, 1905.

Journal of the Meteorological Society of Japan. Tokio. 25th year. No. 10. Oct., 1906.

Sato, T. Construction of the pressure charts on the high-level planes, and their importance to the dynamic meteorology. [Japanese.]

Science. New York. New Series. Vol. 24. Dec. 21, 1906.

Ward, R[obert] DeC[ourcy]. Lantern slides for teaching meteorology. [Abstract.] P. 823.

Science Abstracts. London. Vol. 9. Nov., 1906.

S[tewart], J. J. Time variation of the initial nucleation of wet, dust-free air. [Abstract of article by C. Barus.] Pp. 550-551.

B[orns], H. Existence of the isothermal zone in the atmosphere at the height of 10 to 12 km. [Abstract of article by R. Nimfuhr.] Pp. 551-552.

Scientific American Supplement. New York. Vol. 62. Dec. 8, 1906.

Eliot, John. World weather. Pp. 25962-25963.

School Science and Mathematics. Chicago. Vol. 6. Dec., 1906.

Woodhull, John F. The per cent of oxygen in air. Pp. 762-768.

Symons's Meteorological Magazine. London. Vol. 41. Nov., 1906.

—— The climatological atlas of India. Pp. 181-184.

—— The rainfall of Beira. P. 193.

Annales de la Géographie. Paris. 15 année. 15 nov. 1906.

Le Cointe, Paul. Le climat Amazonien et plus spécialement le climat du bas Amazone. Pp. 447-462.

Annuaire de la Société Météorologique de France. Paris. 54 année. Juillet 1906.

Moureaux, Th. Comparaison entre la température moyenne des minima et maxima diurnes et la moyenne des 24 heures. Pp. 189-195.

Baldit, A. Sur la fréquence des températures à Saint-Maur et à Zi-ka-wei. 10 années 1890-1899. Pp. 195-201.

Maillet, Ed. Sur les pluies des saisons froides dans les bassins de la Seine et de la Loire. Pp. 202-203.

Bulletin de la Société Belge d'Astronomie. Bruxelles. 11 année. Sept.-Oct. 1906.

Paulsen, Adam. Sur la direction des courants électriques dans l'aurore polaire. Pp. 379-380.

Paulsen, Adam. Théorie nouvelle de l'aurore polaire. Pp. 381-394.

Durand-Gréville, E. Rubans et couloirs de grain. Pp. 398-409.

Ciel et Terre. Bruxelles. 27 année.

Rotch, A. Lawrence. Quand Franklin inventa-t-il le paratonnerre? (1 nov. 1906.) Pp. 433-437.

—— La température dans les mines du Witwaterstrand. [Note.] (1 nov. 1906.) Pp. 455.

—— Influence de la vie humaine sur la déperdition électrique de l'air. (1 nov. 1906.) P. 455.

Lancaster, A. and Millot, C. L'été de la Saint-Martin. (16 nov. 1906. Pp. 457-468.

Géographie. Paris. 14. Année 1906. 15 août 1906.

Buffault, Pierre. Le plateau d'Aubrac. [Climate, pp. 64-66.] Pp. 61-78.

Brunhes, H. Représentation graphique de la hauteur de la pluie en fonction de l'altitude. Pp. 119-120.

Revue Néphologique. Mons. Nov., 1906.

Bracke, A. Nuages irisées. P. 81.

Bracke, A. Les halos et la pluie. Pp. 84-85.

Aus dem Archiv der Deutschen Seewarte. 29 Jahrgang. 1906.

Westermann, R. Der meteorologische Æquator im Stillen Ozean. Pp. 1-27.

Beiblätter zu den Annalen der Physik. Leipzig. Band 30. Heft 21.

Aufsees, von. Notice über die zeitliche Abnahme des Dämmerung lichtes. [Abstract of article by E. Hertzsprung.] Pp. 1100-1101.

Stöckl, K. Ueber einige Zerstreuungs-und Bodenluft Messungen in Kiel im Herbst 1905. [Abstract of article by K. Kaehler.] P. 1101.

Mac[he], H. Zum Einfluss der totalen Sonnenfinsternis vom 30 August 1905 auf die erdmagnetischen Variationen. [Abstract of article by A. Nippoldt.] Pp. 1101-1103.

Aufsees, — von. Ueber das Nordlicht. [Abstract of article by P. Villard.] Pp. 1103-1104.

Illustrierte Aëronautische Mitteilungen. Strassburg. 10 Jahrgang. Dez., 1906.

Bassus, K. v. Ueber die Abbildung von Gewässern in Wolkendecken. Pp. 433-434.

Q[uervain, Alfred] de. Die V. Konferenz der internationalen Kommission für wissenschaftliche Luftschiffahrt in Mailand. Pp. 441-442.

Meteorologische Zeitschrift. Braunschweig. Band 23. Nov., 1906.

Margules, Max. Zur Sturmtheorie. Pp. 481-497.

Rheden, Joseph. Wolkenhöhenmessungen mit Hilfe der Scheinwerferanlage des neuen Wiener Leuchtbrunnens. Pp. 497-504.

Quervain, A[lfred] de. Bericht über die V. Konferenz der internationalen Kommission für wissenschaftliche Luftschiffahrt in Mailand. Pp. 505-507.

Hann, J[ulius]. Die "Temperaturumkehr" mit der Höhe im Winterhalbjahr in dem niederösterreichischen Alpengebiete. Pp. 507-509.

Schubert, J. Wärmeaustausch der Seen und Meere. P. 509.

Halbfass, —. Uber den jährlichen Wärmeumsatz in Binnenmeeren. Pp. 509-512.

H[ann], J[ulius]. Zunahme des Regenfalles mit der Seehöhe. Pp. 513-514.

H[ann], J[ulius]. Resultate der meteorologischen Beobachtungen an den beiden Ausgängen der Magalhaesstrasse im Jahre 1904. P. 514.

Riegler, Wahrmund. Bemerkenswerte Hagelformen. Pp. 514-515.

H[ann], J[ulius]. Weitere Ergebnisse der meteorologischen Beobachtungen am Museum Goeldi in Pará. Pp. 515-517.

H[ann], J[ulius]. Der tägliche Gang des Regensfalles und die Maxima desselben auf Java. Pp. 518-519.

Friesendof, —. Abnormes Regenwetter. Pp. 519-520.

—— S. P. Langley's wissenschaftliche Arbeiten. Pp. 520-522.

—— Prof. Dr. Daublebsky v. Sterneck in Czernowitz: über die scheinbare Form des Himmelsgewölbes und die scheinbare Grösse der Gestirne. Pp. 522-523.

Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten. Berlin. 19 Band. 3 Heft 1906.

Uhlig, C. Regenbeobachtungen aus Deutsch-Ostafrika. III. Pp. 274-290.

Naturwissenschaftliche Rundschau. Berlin. 21 Jahrgang. 22. Nov., 1906.

Ekholm, Nils. Die Luftdruckschwankungen und deren Beziehung zu der Temperatur der oberen Luftschichten. Pp. 622-624.

Physikalische Zeitschrift. Leipzig. 7 Jahrgang. 15. Nov., 1906.

Börnstein, R[ichard]. Die halbtägigen Schwankungen der Temperatur und des Luftdrucks. Pp. 836-837.

Lummer, Otto. Ueber die "Inversionstemperatur" des Luft. Pp. 864-865.

Weltall. Berlin. 7. Jahrgang. 1906 Nov. 1.

—— Wilhelm Lamprecht und seine Wettersäule. Pp. 35-36.

Wetter. Berlin. 23. Jahrgang. Nov., 1906.

Schubert, J. Die Witterung in Eberswalde im Jahre 1905. Pp. 241-246.

Ellemann, Fr. Uber die Sichbarkeit des Petersberges. Pp. 247-252.

Arkiv för Matematik, Astronomi och Fysik. Uppsala. Band 3. Häfte 1. No. 3.

Westman, J. Sur la couverture de neige de la Suède centrale et septentrionale.

THE STUDY OF PRACTISE FORECASTING.

By J. L. BARTLETT. Dated Madison, Wis., November 19, 1906.

Anyone who attempts to forecast future atmospheric conditions from weather charts is soon confronted with the problem of classifying the great number of weather types encountered and of formulating general rules for each type or for each set of approximately similar types. After some study of the subject a retentive memory undoubtedly becomes of great value in making rapid forecasts. But for the beginner to attempt to memorize and to classify mentally the weather conditions following the various types from simply examining successive maps is often a discouraging task, especially in view of the fact that no rule of forecasting yet formulated is wholly exempt from failure. Weather forecasting under existing conditions is the problem of determining the average results produced by causes which are more or less fixt. The causes may be considered to be the existing weather conditions at the time the forecast is made; the results are the conditions prevailing during the period forecasted for.

With the foregoing in mind the scheme of tabulating weather charts and portions of their data as shown in the accompanying table has been worked out. This table shows in condensed form the weather conditions prevailing over the Northwest during November, 1905. The general idea of the scheme may be seen at once from the headings of the various columns. In selecting these headings the two great general principles of prediction were kept in view, namely—the eastward movement in this latitude of existing weather conditions, and the influence of high and low pressure centers upon the weather in their vicinities. The following method of tabulation was then carried out.

GENERAL METHOD OF TABULATION.

One line, or more if necessary, is used for the data for each weather chart. On successive lines are placed the data for succeeding charts for the whole month. Under "high" and

"low", respectively, are noted the positions and values of central isobars of the high and low pressure areas nearest the section forecasted for. Distant areas, especially to the eastward, are omitted, unless of great extent, but to the westward all the more important areas are considered. In locating these areas, geographical subdivisions are used instead of quadrants, the former being more exactly defined and more easily tabulated. In the next column is noted the general location of the nearest rain, especially to the westward, during the past twelve hours. Succeeding columns contain data for selected stations, usually to the westward of the region for which forecasts are to be made, the current temperature being first; the 24-hour temperature change, when 6°, or over, second; and the precipitation, if any, third. The p. m. precipitation is in black-faced type. The selection of these stations is a matter of no little importance. As a rule only those should be considered whose temperature, temperature change, and precipitation areas are found to move over the area forecasted for with some regularity. It may be necessary to experiment with a large number of stations in the northern, western, and southern quadrants before those most suitable for study are determined.

In the columns on the right-hand side of the sheet are placed similar data for all stations within the area forecasted for, and covering the period for which forecasts are made. In the case of the accompanying table the a. m. and p. m. data for the day following are used. The resulting weather is thus kept on the same line with the preceding or causal weather, so that by looking along one line the causes producing certain results may be seen at a glance.

DATA TO BE TABULATED.

The selection of data to be tabulated depends upon the class of forecasts issued, and so may vary much for different forecasters. Under "Resulting Weather", at different seasons of the year, should be columns for data relative to high and low temperatures, cold waves, frosts, and, on the coasts, the occurrence of high winds. For careful local forecasting the division of the day, for tabulating precipitation data, into 6-hour instead of 12-hour periods may show interesting results. Under "Causal Weather" additional columns may also be introduced. If 12-hour pressure changes are computed, the position and value each day of the greatest + and − changes may be noted. The tendency of "highs" and "lows" to deviate from normal eastward movement, as indicated by Bowie's graphical method, is undoubtedly of value to tabulate. Besides temperature and precipitation data, that for wind direction and cloudiness would be of interest both under causal and resulting weather, altho the two last elements are not verified in forecasting and are quite closely associated with the centers of high and low pressure. In general, however, excess of data should be avoided and any not found to be of value omitted, thereby avoiding much confusion.

The completed sheet of data shows the weather conditions and changes over a considerable region for the whole month. The preparation of such a sheet has been found to occupy from one and one-half to three hours, depending on the amount of data tabulated. While the study of a single sheet may indicate valuable knowledge, it is thought that as a rule data for not less than five years, for any calendar month, should be considered in attempting to formulate general rules for forecasting.

THE STUDY OF THE DATA.

This is the most interesting and also the most difficult part of the work. The general aim is to learn what percentage of times a certain type of chart produces the same results. Consider, for example, the influence of Alberta "lows" on the p. m. conditions in Wisconsin thirty-six hours later. In the accompanying table such "lows" are shown on six dates, the 1st, 3d, 9th, 18th, 22d, and 25th. In five instances, or 83 per cent of the time, no rain had fallen preceding the p. m. observation thirty-six hours later; in four cases the temperature change was sufficient to have warranted a forecast of "warmer". These facts may then be incorporated into a general rule. The next step is to study such exceptions to this rule, as the occurrence of precipitation on the 2d at Madison and Green Bay, and the absence of a + temperature change on the 18th and 25th. Could these exceptions have been foreseen from any peculiarity of the causal chart, such as the existence of another disturbing pressure center, local rain areas to the westward, abnormal temperature conditions over the area forecasted for, retardation or acceleration of centers indicated by 12-hour pressure changes, or by Bowie's method? Each exception should be traced to its possible causes and a suitable exception to the rule be made. For example, the nonoccurrence of a + temperature change thirty-six hours after the chart of the 18th was due to a slight "high" in Manitoba on that date, which had caused temperatures to fall in the Dakotas; while on the 25th a "low" over Manitoba prevented the Alberta "low" from being attended by warmer weather the next day in Wisconsin. Both of these exceptions could doubtless have been foreseen in actual forecasting. If the rule, when tested, shows a low percentage of verification, it is often better to state it negatively and develop the exceptions from the latter point of view. We may then proceed to consider another type of chart and formulate another rule with its accompanying exceptions. This is continued until all the distinct types of weather charts are covered. This general method of formulating average rules, particularly with regard to precipitation, is well illustrated in Russell's Meteorology.

There is another method of approaching this study, considering the general eastward weather movement as a more important factor in weather prediction than the influence of high and low pressure centers. This seems to be true at some seasons of the year, especially during the warmer months, when areas of precipitation, cloudy weather, and high or low temperature may drift across the country more steadily than do the pressure centers which they accompany. During some months the precipitation and temperature change at any point are quite accurately indicated by the precipitation and temperature change of the previous twenty-four hours at some station to the westward. Working from this point of view, the + temperature changes of 6°, or over, at one of the causal stations are considered and the percentage of cases followed by + changes at any of the "resulting weather" stations is computed. (It seems hardly worth while to consider changes of less than 6° as they neither break a forecast of stationary temperature nor are appreciable to the public.) Falls in temperature and occurrences of precipitation may be similarly considered and average rules determined. At first but one item, as the + change, for one causal station at a time, should be considered, tho after a while it will be found that several stations may be grouped together and considered under their geographic subdivision. Thus, the causal weather at Huron and Pierre may be generalized as South Dakota weather. The exceptions to the average rules found by this method should also be studied and will usually be found to be due to the abnormal movements of pressure centers, unusual temperature conditions, or to local topographical weather controls, such as mountains, valleys, lakes, or oceans.

Doubtless it will be best to study the data both by considering the "highs" and "lows" as the fundamental weather causes, and also by attaching the greater importance to the general eastward weather movement. A large number of general rules, each with its exceptions, will be obtained, but when these are compared it will be found that many can be combined and simplified, so that finally those that are of value may not exceed a dozen in number for each month.

TABLE 1.—*Condensed form showing weather conditions prevailing over the Northwest during November, 1905.*

Causal weather.												Resulting weather in Wisconsin								
Date.	High.		Low.		Nearest rain during past 12 hours.	Temperatures, 24-hour changes, and precipitation.						Date.	Temperatures, 24-hour changes, and precipitation.							
	Location.	Strength.	Location.	Strength.		Moorhead.	Bismarck.	Huron.	Pierre.	Omaha.	N. Platte.		La Crosse. a. m.	La Crosse. p. m.	Madison. a. m.	Madison. p. m.	Green Bay. a. m.	Green Bay. p. m.	Milwaukee. a. m.	Milwaukee. p. m.
		Inches.		*Inches.*																
1	Kansas	30.4	Alberta	29.6	Upper Michigan	10 −8	14 −18	16 −20	20 −14	28	22	2	30 +10	42 +16	24 +2	38 +10 .02	22 +4	36 +12 .12	28 +6	38 +8 T.
2	West Virginia Nevada	30.2 30.2	West Minnesota	29.5		28 +18	34 +20	36 +20	46 +26	38 +10	30 +8	3	36 +6	36 −6	36 +12	38	32 +10	30 −6	36 +8 .01	40 +2
3	Kansas	30.1	Lake Superior Alberta	29.55 29.5	E. Wisconsin, Minnesota, Michigan.	30 .04	24 −10	28 −8	28 −18	34	24 −6	4	28 −8	50 +14	28 −8	44 +6	24 −8	38 +8	32	42
4	Kentucky	30.2	Manitoba New Mexico	29.7 29.6	Kansas, Oklahoma	32	30 +6	34 +6	34 +6	40 +6	38 +14	5	44 +16 .04	40 −10 1.22	42 +14 T.	40 .58	40 +16	40 .26	42 +10	42 .24
5	Oregon	30.4	Missouri	29.5	W. Wisconsin, Minnesota, Iowa.	28	26	36	36	44 1.56	40	6	34 −10 .02	34 −6	36 −6 .04	34 −6	36 .38	36	40 .20	36 −6
6	Kansas	30.3	Lake Ontario Saskatchewan	29.55 29.85	Wisconsin, Michigan	24	30	26 −10	26 −10	32 −12 .08	26 −14	7	32 .14	34 T.	32 .34	34 T.	32 T.	32	32 −8 .28	34 T.
7	Idaho	30.3	Illinois	29.7	Wisconsin, Minnesota	26 .04	32	34 +8	36 +10 T.	42 +10	34 +8	8	32	34 T.	30	32	24 −8	30 T.	32	34 T.
8	Idaho Arkansas	30.2 30.1	North Dakota	29.9	South Dakota	30	36 .06	38 .02	46 +10 .01	36 −6	34	9	26 −6	34	28	32	24 T.	32	26 −6 T.	32
9	Wyoming	30.4	Alberta	29.9	Michigan	22 −8	36	32 −6 T.	30 −16	32	32	10	28	44 +10	30	40 +8	34 +10	42 +10	30	42 +10
10	Kansas	30.5	Saskatchewan	29.9	Upper Michigan	28 +6	28 −8	24 −8	26	38 +6	24 −8	11	36 +8	56 +12	34	52 +12	36	50 +8	30	52 +10
11	Missouri Wyoming	30.4 30.5	Lake Superior	29.85		30	34 +6	28	32 +6	38	26	12	42 +6	52	40 +6	50	38	50	42 +12	52
12	Idaho	30.5	East Ontario	29.7		34	36	34 +6	36	36	28	13	38	30 −22	38	26 −24 T.	38	22 −28	42	32 −20 T.
13	Manitoba Idaho	30.3 30.5	Wisconsin	29.75	Upper Michigan	34	40	46 +12	46 +10	42 +6	32	14	18 −20	36 +6	18 −20	30	14 −24	32 +10	18 −24 T.	32
14	Iowa Oregon	30.2 30.3	Saskatchewan	29.5		26 −8	34 −6	24 −22	28 −18	38	28	15	44 +26	42 +6 .02	40 +22	40 +10 .03	38 +24	34 T.	36 +18	40 +8 .01
15	Idaho	30.2	Lake Superior	29.1	Upper Michigan, Manitoba.	36 +10	42 +8	40 +16	44 +16	42	36 +8	16	36 −8	48 +6	38 .01	42	32 −6	38	36 .07	42
16	New Mexico	30.1	Saskatchewan	29.55	Upper Michigan, Southeast Wisconsin.	28 −8	34 −8	30 −10	38 −6	44	32	17	42 +6	44	40	44	36	38	40	42
17	Montana	30.0	Kansas N. Wisconsin	29.8 29.7	Upper Michigan	28	36	32	36	44	48 +16	18	30 −12	42	34 −6	40	26 −10	36	36	38
18	Manitoba	30.1	Oklahoma Alberta	29.8 29.5		20 −8	32	28	34	36 −8	32 −16	19	28	40	28 −6	36	30	36	38	38
19	Upper Lakes Nebraska	30.2 30.2	British Columbia	29.6	Dakotas	34 +14 .02	28 .04	28 T.	30	36	26 −6	20	28	38	34 +6	36	32	36	40	36
20	East Ontario	30.5	Saskatchewan	29.65	Washington, Oregon	30	34 +6	36 +8	34	34	32 +6	21	30	40	26 −8	36	34	34	34 −6	36
21	East Ontario	30.7	Utah E. Saskatchewan	29.7 30.05	Wyoming	36 +6	32	34	40 +6	34	32	22	32	48 +8	26	44 +8	30	40 +6	30	46 +10
22	North Carolina	30.6	Alberta	29.75	Utah	26 −10	20 −12	26 −8	28 −12	38	32	23	42 +10 T.	52 .18	38 +12	54 +10 T.	34	50 +10	42 +12	50
23	North Carolina	30.4	W. South Dakota	29.65	Dakotas, Minnesota	46 +20 .04	46 +26	50 +24 T.	52 +24 T.	48 +10 .12	46 +14 .24	24	42 .08	34 −18 .01	50 +12 .34	34 −20 .02	54 +20 .24	36 −14 T.	56 +14 .02	40 −10 T.
24	Utah	30.2	Saskatchewan W. Lake Superior	29.6 29.0	Wisconsin, Nebraska, Minnesota, Iowa, Dakotas.	26 −20 .76	20 −26 .46	26 −24 .44	30 −22 .12	38 −10 .58	32 −14 .10	25	32 −10 T.	44 +10	28 −22	34 .02	30 −24	38 .10	30 −26 T.	38 .02
25	Nevada	30.2	Alberta Manitoba	29.4 29.5	Wisconsin, Michigan	32 +6 .04	30 +10	32 +6	36 +6	38	32	26	30	30 −14	34 +6	32	34	30 −8	34	34

TABLE 1.—*Condensed form showing weather conditions prevailing over the Northwest during November, 1905*—Continued.

Causal weather.												Resulting weather in Wisconsin.								
	High.		Low.			Temperatures, 24-hour changes, and precipitation.							Temperatures, 24-hour changes, and precipitation.							
													La Crosse.		Madison.		Green Bay.		Milwaukee.	
Date.	Location.	Strength.	Location.	Strength.	Nearest rain during past 12 hours.	Moorhead.	Bismarck.	Huron.	Pierre.	Omaha.	N. Platte.	Date.	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.	a. m.	p. m.
		Inches.		*Inches.*																
26	Dakotas Saskatchewan	30.0 30.1	East Ontario	29.7	Montana, Lake Superior.	28	20 −10	24 −8	30 −6	36	28	27	30	36 +6 .16	30	36 ...... T.	28 −6	36 +6	38	40 +6 ......
27	Saskatchewan	30.5	Utah	29.3	Dakotas, Montana	22 −6 .04	16 ...... .04	30 +6	30 ...... T.	36	32	28	44 +14 .68	36 ...... T.	44 +14 .80	42 +6	38 +10 .48	38	42 ...... .36	52 +12 ......
28	Saskatchewan	30.4	Minnesota	29.15	Wisconsin, Iowa, Dakotas, Minnesota.	22 .... .96	6 −10 .52	28 ...... .68	16 −14 .36	36 ...... .36	24 −8 .08	29	18 −26 T.	10 −26	20 −24 T.	16 −26 T.	28 −10 T.	14 −24 T.	26 −16 T.	22 −30 T.
29	West Dakotas	30.6	East Ontario	29.4	Wisconsin, Iowa, Dakotas, Minnesota.	−6 −28 .38	−8 −14 .22	0 −28 .04	2 −14 .10	8 −28 T.	6 −18 .24	30	2 −16	18 +8	8 −12	18	10 −18	18	12 −14	26 ...... T.
30	Minnesota	30.8	Utah British Columbia.	29.9 29.8	Upper Michigan, Oregon	−26 −20	−14 −6	−12 −12	−6 −8	4	4	Dec. 1	22 +20	....	20 +12	26 +8	26 +16	32 +14	30 +18	32 +6 ......

The rules obtained by this method are of course largely empirical and are not to be depended upon absolutely in making practical forecasts. Watchfulness of local conditions and careful consideration of the daily peculiarities and abnormalities in the regular march of weather conditions across the country are of much importance for making accurate local forecasts. On the other hand it will hardly be possible for anyone who has a fair knowledge of meteorological phenomena to pursue the study of the problem of forecasting as outlined above without obtaining a better knowledge of its fundamental principles.

SPECIMEN RULES.

From a limited amount of data the following specimen rules for the month of November have been formulated, applicable particularly to the southern portion of Wisconsin.

1. A decided 24-hour rise in temperature (20° or more) in eastern South Dakota, closely attending a low, except when no rain has fallen in the Northwest, indicates rain the following night in Wisconsin.

2. A decided low (central isobar 29.3 inches or lower) in the Southwest (Kansas, Colorado, or Utah), with rain in North Dakota, indicates rain the next night period.

3. A general rise of temperature in the Dakotas, amounting to 6° or more, accompanied by rain in the Southwest (Oklahoma and Kansas) indicates rain either the next night or the following day.

4. A. M. rain in Nebraska, except when attending a fall in temperature, will be followed by rain in one of the periods forecasted for.

5. A distinct high in Iowa, Kansas, or Missouri, with a low northwest of it, will be followed by rising temperature in both periods. Exceptions: The high over Kansas must be 30.4 inches, or more, at center; when the temperature is comparatively very low in the Dakotas, no rise will follow.

6. A decided rise of temperature in the Dakotas, attending a low, indicates a rise in the a. m. period.

7. A low in Alberta or British Columbia, unless disturbing pressure centers intervene, indicates a p. m. temperature rise.

8. A decided low in the Southwest will cause an a. m. temperature rise.

9. A 20° fall in temperature in the Dakotas, following a low, indicates an a. m. fall in temperature.

10. A low (central isobar 0.2 inch below the normal) over Minnesota, Superior, or Wisconsin, except when there has been a decided rise in the Dakotas, indicates an a. m. temperature fall.

11. A similar low over Minnesota indicates a p. m. temperature fall.

12. Fair weather, with stationary temperature, is generally indicated in all cases not covered by the preceding rules.

The foregoing rules, applied to the data from which they were derived, gave forecasts with a verification (under the present system) of 94 per cent for precipitation, and 85 per cent for temperature. These percentages would not of course hold absolutely for other data, but it would seem that any loss in percentage of verification should be partially compensated by the forecaster's familiarity with the existing weather movement.

THE EVAPORATION OF ICE.[1]

By F. C. MITCHELL, Camden, Me.

The object of this series of experiments on the evaporation of clear ice and snow is to determine to what degree the evaporation is affected by (*a*) temperature, (*b*) amount of atmospheric pressure, (*c*) velocity of wind, and (*d*) area of exposed surface.

Experiments have been performed on the evaporation of liquids and several laws stated, and it has been assumed that the laws for the evaporation of solids like ice follow those for liquids.

Dalton stated that:

> Evaporation is that process by which liquids and *solids* assume the gaseous state at their free surfaces. The *rate* of evaporation depends upon temperature of the liquid or *solid*, the extent of the exposed surface, and the facility with which the gaseous particles can escape from the neighborhood of the surface either by diffusion through the air or by the motion of the air itself.

This is equivalent to saying that evaporation of liquids and solids depends upon temperature, amount of exposed surface, atmospheric pressure, humidity, and wind.

The evaporation of a liquid may be seen at any time, and that of a solid such as ice may be observed in the winter and spring, when snow disappears with the temperature continuously below 0° C. Some chemical substances, such as camphor and iodine, evaporate at ordinary pressure and temperature without first passing into the liquid state.

Two different methods were used in my experiments, which continued thruout the first three weeks of the month of March, 1906, whenever the temperature remained below 0° C. During the first two weeks of the month the conditions were

[1] These investigations were suggested to me by Prof. James S. Stevens, of the University of Maine, and presented as a thesis to the department of physics of that institution, at Orono.

quite favorable. Attempts were made previous to March, but the weather was so mild for a greater part of the winter months (December, January, and February) that nothing could be accomplished from which any conclusions could be drawn.

FIRST METHOD.

A piece of clear ice, in a cubical form, measuring 5 cm. on a side or 125 cm³. was weighed in a small wire holder so arranged that ice was exposed to the air freely on all sides. After each weighing the ice with holder was taken from the balances and suspended in the free atmosphere. The temperature was carefully taken, to tenths of a degree, and the barometric pressure to hundredths of an inch. These readings of weight, temperature, and pressure were recorded every hour during the day from 9 a. m. to 4 or 5 p. m., for seven successive days, except part of the fourth day. (See Table 1). A smaller piece of ice was used on the last three days instead of the original piece.

This experiment was performed in the unfinished attic of the Camden High School building.

A maximum and minimum thermometer hung near the piece of ice, and from this the maximum and minimum temperatures were taken for each night excepting the first—February 28.

The average evaporation per hour was computed for five of the nights. It was found that this hourly evaporation during the nights was considerably less than during the days.

TABLE 1.—*Data obtained by weighing method.*

[Surface area, 150 cm.². Volume, 125 cm.³.]

Date.	Hour.	Temp.	Pressure.	Weight of ice.	Loss in weight per hour.	Remarks.
1906.		° C.	*Inches.*	*Grams.*	*Grams.*	
February 28..	9	−8.0	29.50	115.360	....	Cloudy.
Do.......	10	−8.0	29.50	115.224	0.136	
Do.......	11	−8.1	29.50	115.089	0.135	
Do.	12	−8.0	29.52	114.954	0.135	
Do.......	1	−7.8	29.51	114.816	0.138	
Do.......	2	−7.3	29.50	114.676	0.140	
Do.......	3	−7.1	29.50	114.533	0.143	
Do.......	4	−6.9	29.49	114.386	0.147	
Average....	9 to 4	−7.7†	29.50†	....	0.139	
Feb. 28–Mar. 1 Average....	4 to 9	... .	(29.60)	....	0.110	Minimum temperature, −11° C.
March 1......	9	−7.3	29.70	112.511	....	Partly cloudy.
Do.......	10	−7.1	29.70	112.362	0.149	
Do.......	11	−6.9	29.71	112.206	0.156	
Do.......	12	−6.6	29.70	112.048	0.158	
Do.......	1	−6.0	29.71	111.888	0.160	
Do.......	2	−5.2	29.70	111.723	0.165	
Do.......	3	−4.9	29.72	111.559	0.164	
Do.	4	−5.1	29.72	111.395	0.164	
Average....	9 to 4	−6.1†	29.71†	....	0.159	
March 1–2, Average....	4 to 9	... .	(29.88)	....	0.116	Minimum temperature, −10° C.
March 2......	9	−8.1	30.05	109.430	....	Fair.
Do.......	10	−8.0	30.09	109.292	0.138	
Do.......	11	−7.6	30.10	109.150	0.142	
Do.	12	−7.1	30.00	109.003	0.147	
Do.......	1	−6.5	30.02	108.838	0.165	Error due to hasty reading.
Do	2	−6.2	30.00	108.695	0.143	
Do.......	3	−5.7	29.95	108.535	0.160	
Do.......	4	−5.5	29.93	108.375	0.160	
Do.	5	−6.0	29.93	108.203	0.172	
Average....	9 to 5	−6.7†	30.01†	....	0.153	
March 2–3. Average....	5 to 8	....	(29.56)	....	0.156	Minimum temperature, −6.5° C.
March 3......	8	−5.0	29.20	105.857	....	
Do.......	9	−3.7	29.00	105.687	0.170	
Do.	10	−1.0	29.00	105.509	0.178	
Do.......	11	0.0	*	(103.807)	(1.702)	

*No reading taken. †The first and last readings of the series were given half weight.

On March 3, at 11 o'clock, the temperature became 0° C., and as the ice began to melt no further readings were taken.

The dimensions of the cubical piece of ice used decreased in the seventy-four hours from 5 cm. to 4.85 cm., or the volume from 125 cm.³ to 114.07 cm.³, while the weight decreased from 115.360 g. to 103.807 g. or a loss of 11.553 g., making an average hourly decrease by evaporation of 0.156 g., approximately.[2]

From these data it may be seen that the amount of evaporation increases as the temperature increases when the pressure remains constant, and as the experiment was performed indoors there was no wind or air currents. The glass sliding door of the balance was kept down while all weighings were being made to avoid the effect of heat on the experiment. During each of these days the pressure was quite constant. February 28 it was about 29.5 inches, March 1 approximately 29.7, while on March 2 it was 30, and during the time on the 3d that the temperature was below 0° C. the pressure was 29 inches, so we may consider each of these days as having a fairly constant barometric pressure, and consequently determine the effect of temperature change during each day.

During the first day the temperature increased from −8° C. to −6.9° C., while the amount of evaporation increased from 0.136 g. to 0.147 g. per hour. The second day the temperature increased from −7·3° C. to −5.1° C., the evaporation per hour from 0.149 g. to 0.164 g. The third day the temperature increased from −8.1° C. to −6° C., the evaporation from 0.138 g. to 0.172 g. per hour.

It may be seen also that the amount of evaporation increases as the atmospheric pressure increases. This is due, without doubt, to the fact that the relative humidity of the free atmosphere is generally less during high pressures than during low pressures. It also seems that the evaporation is less on cloudy days than on partly cloudy, and less when partly cloudy than when fair. At 2 p. m. the first day is noticed a temperature of −7.3° C.; at the end of an hour, −7.1° C.; while the amount of evaporation for the hour is 0.143 g. On the second day at 9 and 10 a. m. we find the same temperatures but an amount of evaporation of 0.149 g., or an increase of 0.006 g. per hour. On the first day from 9 to 10 a. m. we find an evaporation of 0.136 g., while on the third day for the same hour we have 0.138 g. evaporation. As all other conditions[3] apparently remain the same the conclusion is that the evaporation increases with atmospheric pressure, or with a decrease of humidity.

The minimum temperature for each night was recorded by the maximum and minimum thermometer. It was found that the amount of evaporation per hour during the night is considerably less than during the day, the average for the three nights being 0.126 g. per hour, while the average for an hour during the first three days is 0.151 g.

Next a piece of ice in the cubical form, as nearly as could be cut and shaved, with sides of 3.54 cm. or volume 44.356 cm³., was used, and the data in Table 2 obtained, the method of procedure being the same as in the previous case. It will be noticed that the amount of exposed surface in this case is approximately one-half as great as in the previous part of the work.

The data in Table 2 were obtained by the same method, the same apparatus, and in the same place as the data in Table 1.

The average evaporation was 0.0632 g. per hour. The area of the exposed surface was approximately one-half of that in the first part, being 75.18 cm²., while in the first it was 150 cm². The amount of evaporation was approximately one-half, thus justifying the statement that the amount of evaporation is proportional to the area of the exposed surface.

The second table shows, as the first did, that the amount of evaporation increases as the temperature increases.

[2] The tenfold rate of loss in weight in the last hour makes one suspicious that melting occurred before the weighing; probably a truer average would be found by computing merely for the seventy-three hours ending at 10 a. m., March 3. The loss in weight during this period was 9.851 g., which amounts to an average loss per hour of 0.135 g.—EDITOR.

[3] There was presumably a *decrease* in the exposed surface area, at a rate approximating, on the average, 2 per cent a day; this would make the *increase* of evaporation all the more notable.—EDITOR.

TABLE 2.—*Data obtained by weighing method.*

[Surface area, 75.18 cm.². Volume, 44.36 cm.³.]

Date.	Hour.	Temp.	Pressure.	Weight of ice.	Loss in weight per hour.	Remarks.
1906.		°*C.*	*Inches.*	*Grams.*	*Grams.*	
March 4......	9	−10.5	30.30	40.810	....	Fair.
Do	10	−10.1	30.30	40.746	0.064	
Do	11	− 9.6	30.31	40.671	0.075	
Do	12	− 8.5	30.31	40.606	0.065	
Do	1	− 8.0	30.30	40.539	0.067	
Do	2	− 7.3	30.28	40.473	0.066	
Do	3	− 5.1	30.29	40.406	0.067	
Do	4	− 5.2	30.30	40.341	0.065	
Do	5	− 5.4	30.30	40.273	0.068	
Average ...	9 to 5	− 7.7†	30.30†	....	0.067	
March 4-5. Average ...	5 to 9	....	(30.29)	....	0.060	Minimum temperature −12° C.
March 5......	9	− 8.9	30.28	39.313	....	Fair.
Do	10	− 8.2	30.26	39.251	0.062	
Do	11	− 7.3	30.25	39.186	0.065	
Do	12	− 6.1	30.25	39.116	0.070	
Do	1	− 5.0	30.25	39.054	0.062	
Do	2	− 4.9	30.26	38.994	0.060	
Do	3	− 5.2	30.27	38.931	0.063	
Do	4	− 6.0	30.27	38.863	0.068	
Do	5	− 7.8	30.27	38.799	0.064	
Average ...	9 to 5	− 6.4†	30.26†	....	0.064	
March 5-6. Average ...	5 to 9	....	(30.18)	....	0.061	Minimum temperature −10.5° C.
March 6......	9	− 6.0	30.10	37.823	....	Cloudy in a. m.
Do	10	− 5.4	30.11	37.757	0.066	Fair in p. m. with heavy wind.
Do	11	− 4.3	30.08	37.690	0.067	
Do	12	− 3.6	30.08	37.620	0.070	
Do	1	− 3.4	30.07	37.555	0.065	
Do	2	− 2.2	30.09	37.487	0.068	
Do	3	− 2.0	30.09	37.418	0.069	
Do	4	− 1.5	30.09	37.346	0.072	
Do	5	− 1.5	30.08	37.271	0.075	
Average ...	9 to 5	− 3.3†	30.09†	....	0.069	

† The first and last readings of the series were given half weight.

[*To be continued.*]

HARMONIC ANALYSIS OF THE DIURNAL BAROMETRIC CURVE AT WASHINGTON, D. C.

By W. J. BENNETT, B. S., Observer. Dated Charlotte, N. C., November 12, 1906.

Averages of hourly barometric readings at Washington, D. C., for fourteen years, 1891–1904, show a diurnal variation of .0637 inch, with a maximum occurring about 10 a. m., and a minimum about 4 p. m. There is another maximum occurring about 11 p. m., and another minimum at 3 a. m., tho the difference between these is only .0073 inch. Similar phenomena are found at all stations when hourly barometer observations are averaged, but at places having an oceanic climate the two maxima and the two minima are nearly equal. The day maximum and minimum might be accounted for by the diurnal change in temperature, the maximum barometer being connected with the low morning temperature, and the minimum barometer with the high afternoon temperature, but no such simple explanation will account for the night maximum and minimum. The method of harmonic analysis has been employed by Prof. F. N. Cole,[1] and by others to throw some light on the subject. When diurnal barometer curves from various stations are analyzed into their components it is found that the first, or diurnal component, varies greatly from place to place, its phases differing by several hours, and its amplitude, very large over continental interiors, becoming very small over the ocean. This component, then, appears to be due largely to local causes, especially to the diurnal range in temperature. The second component, with a semidiurnal period, is quite uniform over the world, and does not seem affected to any great degree by local causes. The third and fourth components have much smaller amplitudes than the first and second. They are more uniform in phase and amplitude than the first, but less uniform than the second.

[1] The Diurnal Variation of Barometric Pressure. By Frank N. Cole. Weather Bureau Bulletin No. 6. Washington, 1892.

The object of my study was to compare data obtained from the analyses of barometer curves for several different periods of years at the same place, and by such comparison to obtain some idea as to the reality, magnitude, and fluctuations of the first four components. Averages were taken of hourly barometer readings at Washington, D. C., (corrected for temperature and instrumental error only) for the periods 1891–1894, 1895–1899, and 1900–1904, and independent calculations were made for the whole 14-year period 1891–1904.

An outline of the mathematical development of the equations used may render clearer the results obtained. The ordinary cosine curve has the equation

$$y=P\cos x,$$

where P is the amplitude, or one-half the difference between the maximum and minimum ordinates. If the first maximum does not fall on the line $x=0$, the equation becomes

$$y=P\cos(x-M),$$

where M is the epoch or distance of the first maximum from the line $x=0$. For a curve of twice the frequency the equation becomes

$$y=P_2\cos 2(x-M_2),$$

and for a curve of n times the frequency,

$$y=P_n\cos n(x-M_n).$$

For a curve made up of a number of superimposed cosine curves, as the diurnal barometer curve is supposed to be, we have

$$Y=y_1+y_2+y_3 \ldots\ldots +y_n,$$

and

$$Y=P_1\cos(x-M_1)+P_2\cos 2(x-M_2)\ldots\ldots+P_n\cos n(x-M_n).$$

Expanding:

$$Y=P_1\cos x\cos M_1+P_1\sin x\sin M_1+P_2\cos 2x\cos 2M_2+P_2\sin 2x\sin 2M_2+\ldots\ldots+P_n\cos nx\cos nM_n+P_n\sin nx\sin nM_n.$$

Taking only four components, and letting

$Q_1=P_1\cos M_1$; $Q_n=P_n\cos nM_n$; and $R_1=P_1\sin M_1$; $R_n=P_n\sin nM_n$, we have:

$$Y=Q_1\cos x+R_1\sin x+Q_2\cos 2x+R_2\sin 2x+Q_3\cos 3x+R_3\sin 3x+Q_4\cos 4x+R_4\sin 4x.$$

There are eight unknown quantities, and if we have hourly means there will be twenty-four equations as x varies from 15° to 360°. The first and last of these will be:

$$Y_1=Q_1\cos 15°+R_1\sin 15°+Q_2\cos 30°+R_2\sin 30°+Q_3\cos 45°+R_3\sin 45°+Q_4\cos 60°+R_4\sin 60°.$$

$$Y_{24}=Q_1\cos 360°+R_1\sin 360°+Q_2\cos 720°+R_2\sin 720°+Q_3\cos 1080°+R_3\sin 1080°+Q_4\cos 1440°+R_4\sin 1440°.$$

By the principle of least squares, these equations may be reduced to eight, of which the first will be

$$12\,Q_1=Y_{24}-Y_{12}+(Y_1-Y_{13}+Y_{23}-Y_{11})\cos 15°+(Y_2-Y_{14}+Y_{22}-Y_{10})\cos 30°+(Y_3-Y_{15}+Y_{21}-Y_9)\cos 45°+(Y_4-Y_{16}+Y_{20}-Y_8)\cos 60°+(Y_5-Y_{17}+Y_{19}-Y_7)\cos 75°.$$

The equations are given in full by Professor Ferrel (Report of the Chief Signal Officer, 1885, Part 2, page 342).

From the values of Q's and R's so obtained the values of P's and M's are calculated by the relations

$$\frac{R_n}{Q_n}=\frac{P_n\sin nM_n}{P_n\cos nM_n}=\tan nM_n$$

$$\log.\tan nM_n=\log.R_n-\log.Q_n.$$

$$P_n=\frac{Q_n}{\cos nM_n};\ \log.P_n=\log.Q_n-\log.\cos nM_n.$$

In these calculations careful attention must be paid to plus and minus signs, since $+Q_n$ and $+R_n$ put the angle nM_n in the first quadrant, $-Q_n$ and $+R_n$ in the second, $-Q_n$ and $-R_n$ in the third, and $+Q_n$ and $-R_n$ in the fourth. The factors P

from their nature are positive, since they are fractions of an inch barometric pressure, the length of the maximum ordinate for the given component.

TABLE 1.

Period.		P_1.	M_1.	P_2.	M_2.	P_3.	M_3.	P_4.	M_4.
		Inch.	*h. m.*	*Inch.*	*h. m.*	*Inch.*	*h. m.*	*Inch.*	*h. m.*
January,	1891-1894	.0123	6:50	.0189	9:27	.0080	2:21	.0037	3:53
	1895-1899	.0145	8:38	.0168	9:34	.0082	2:18	.0040	4:01
	1900-1904	.0199	5:59	.0201	9:28	.0089	2:18	.0044	4:03
	1891-1904	.0143	7:32	.0180	9:31	.0085	2:25	.0042	3:55
April,	1891-1894	.0211	7:01	.0185	10:04	.0011	7:08	.0016	6:17
	1895-1899	.0238	6:33	.0178	10:04	.0007	6:18	.0007	7:23
	1900-1904	.0244	6:24	.0180	9:59	.0011	5:55	.0012	8:25
	1891-1904	.0239	6:32	.0183	10:01	.0010	6:32	.0008	6:59
July,	1891-1894	.0219	7:58	.0147	10:39	.0014	6:55	.0014	6:21
	1895-1899	.0210	7:59	.0140	10:20	.0014	6:24	.0009	6:20
	1900-1904	.0210	7:16	.0155	10:23	.0026	6:21	.0008	6:07
	1891-1904	.0213	7:45	.0141	10:19	.0016	6:37	.0008	5:40
October,	1891-1894	.0180	6:56	.0185	9:47	.0025	2:05	.0003	5:27
	1895-1899	.0230	6:45	.0174	9:46	.0042	2:13	.0004	3:10
	1900-1904	.0164	7:02	.0213	9:44	.0042	2:00	.0011	4:27
	1891-1904	.0195	6:44	.0192	9:46	.0031	2:08	.0004	4:23
Year,	1891-1894	.0164	7:01	.0168	9:53	.0013	2:27	.0009	4:52
	1895-1899	.0203	7:11	.0168	9:56	.0021	2:15	.0005	4:38
	1900-1904	.0208	6:57	.0176	9:54	.0030	2:11	.0007	4:01
	1891-1904	.0192	7:02	.0174	9:55	.0018	2:18	.0007	4:40

TABLE 2.

Month.	P_1.	M_1.	P_2.	M_2.	P_3.	M_3.	P_4.	M_4.
	Inch.	*h. m.*	*Inch.*	*h. m.*	*Inch.*	*h. m.*	*Inch.*	*h. m.*
January	.0143	7:32	.0180	9:31	.0085	2:25	.0042	3:55
February	.0179	6:34	.0188	9:42	.0066	2:36	.0009	5:20
March	.0190	6:33	.0186	9:41	.0032	2:03	.0015	6:37
April	.0239	6:32	.0183	10:01	.0010	6:32	.0008	6:59
May	.0241	6:58	.0173	10:08	.0026	6:10	.0013	6:14
June	.0214	7:38	.0142	10:22	.0023	6:34	.0008	7:09
July	.0213	7:45	.0141	10:19	.0016	6:37	.0008	5:40
August	.0185	8:08	.0152	10:34	.0009	5:29	.0005	6:10
September	.0218	7:35	.0177	10:09	.0010	2:53	.0007	4:30
October	.0195	6:44	.0192	9:46	.0031	2:08	.0004	4:23
November	.0176	6:19	.0188	9:23	.0050	2:07	.0014	4:27
December	.0132	6:36	.0197	9:30	.0043	1:40	.0031	4:06
Year	.0192	7:02	.0174	9:55	.0018	2:18	.0007	4:40

In Table 1 are given values of *P's* and *M's* obtained from independent calculations for each of the four periods, 1891–1894, 1895–1899, 1900–1904, and 1891–1904. The remarkably close agreement among the figures would seem to indicate that the four components are not mathematical fictions, but physical realities. Table 2 gives monthly and annual values for the whole 14-year period, 1891–1904.

It will be seen that the amplitude of the first component is greatest in early summer and least in early winter, the difference between the values for May and December being .0109 inch. This variation agrees closely with the mean daily range in temperature, which is greatest in May and least in January. Following are the mean monthly temperature ranges for the same fourteen years:

Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean in °F.	15.1	16.0	17.4	19.3	21.2	19.3	19.0	18.6	19.1	19.0	17.8	16.7

The time of the maximum of the first component averages about an hour later than that of the lowest temperature for the day, but considering it by months we notice a double oscillation, as it occurs later in summer and winter than in spring and autumn. This may possibly be due to the fact that the lowest temperature occurs earlier and the highest later in summer than in winter. In the spring the hour of the lowest temperature recedes more rapidly than that of the highest advances, the tendency being to throw the epoch of the first component earlier. As summer advances the highest temperature occurs later, while the lowest changes its position but slightly, and the epoch is thrown later. During the autumn the highest temperature comes earlier, while the change in the lowest is still small, throwing the epoch earlier again. During the winter the lowest temperature advances while the highest remains nearly stationary, and thus the cycle is completed by the epoch occurring later. It seems, then, that the first component is largely the effect of local temperature changes, and this theory is made more probable by the fact that at places having an oceanic climate, with small diurnal temperature range, the amplitude of the first component is the least, while at places having a continental climate, with great diurnal temperature range, the amplitude is greatest.

It must be noted here that since the temperature change from lowest to highest is nearly twice as rapid as that from highest to lowest, its effect upon the barometer can not be ascertained accurately by a method of harmonic analysis which forces the maximum and minimum of the first component to occur exactly twelve hours apart. Some of the temperature effect must be taken up by the second component, which has maxima and minima occurring six hours apart, and which will have a maximum later and a minimum earlier than the maximum and minimum, respectively, of the first component. An attempt to find the value of the temperature effect thus lost by the first component and gained by the second, and to eliminate roughly from the diurnal curve the direct effect of temperature, was made in the following manner: As the lowest temperature occurs about 6 a. m. and the highest about 3 p. m., eight instead of fourteen values of Y were taken in the interval between 3 p. m. and 6 a. m., and analysis made on the basis of eighteen observations, with temperature extremes occurring at intervals of nine. The amplitude of the first component thus obtained was .0253 inch, or .0061 greater than that obtained before. The epoch fell at 6:16 a. m. Plotting this curve, and then subtracting its ordinates from the corresponding ordinates of the normal barometer curve, gave a curve from which the direct effect of temperature was eliminated, and this was then analyzed by the usual method. The values then obtained for the second, third, and fourth components were as follows:

P_2 .0123	P_3 .0008	P_4 .0017
M_2 10:11 a. m.	M_3 3:45 a. m.	M_4 3:21 a. m.

The second component has its greatest amplitude in winter and its least in summer, the variation being inversely as the amplitude of the first component, but only about half as great, or .0056. A cause for this and a second possible cause for the variation of the first component may be found in the fact that the interval between the lowest and highest temperatures for the day is greater in summer than in winter. More of the temperature effect would therefore appear in the first component in summer and less in winter. The reverse would be true in regard to the second component. The epoch of the second component also shows an annual variation, being about an hour later in summer than in winter. This variation is quite uniform over the world and seems independent of local conditions, but its cause is not understood. After eliminating roughly the direct temperature effect, as by the method above given, the amplitude of the second component appears reduced from .0174 to .0123, or by about a third. The smaller figure is still considerable.

If the semidiurnal component is due to a tidal effect of the sun, then there should be a lunar barometric tide also, and this of greater amplitude. In studying this question the barograph trace sheets at Charlotte, N. C., (those of Washington not being available) were examined, and twenty-four readings were taken every twenty-four hours and fifty minutes, beginning with the moon's culmination. Averages were

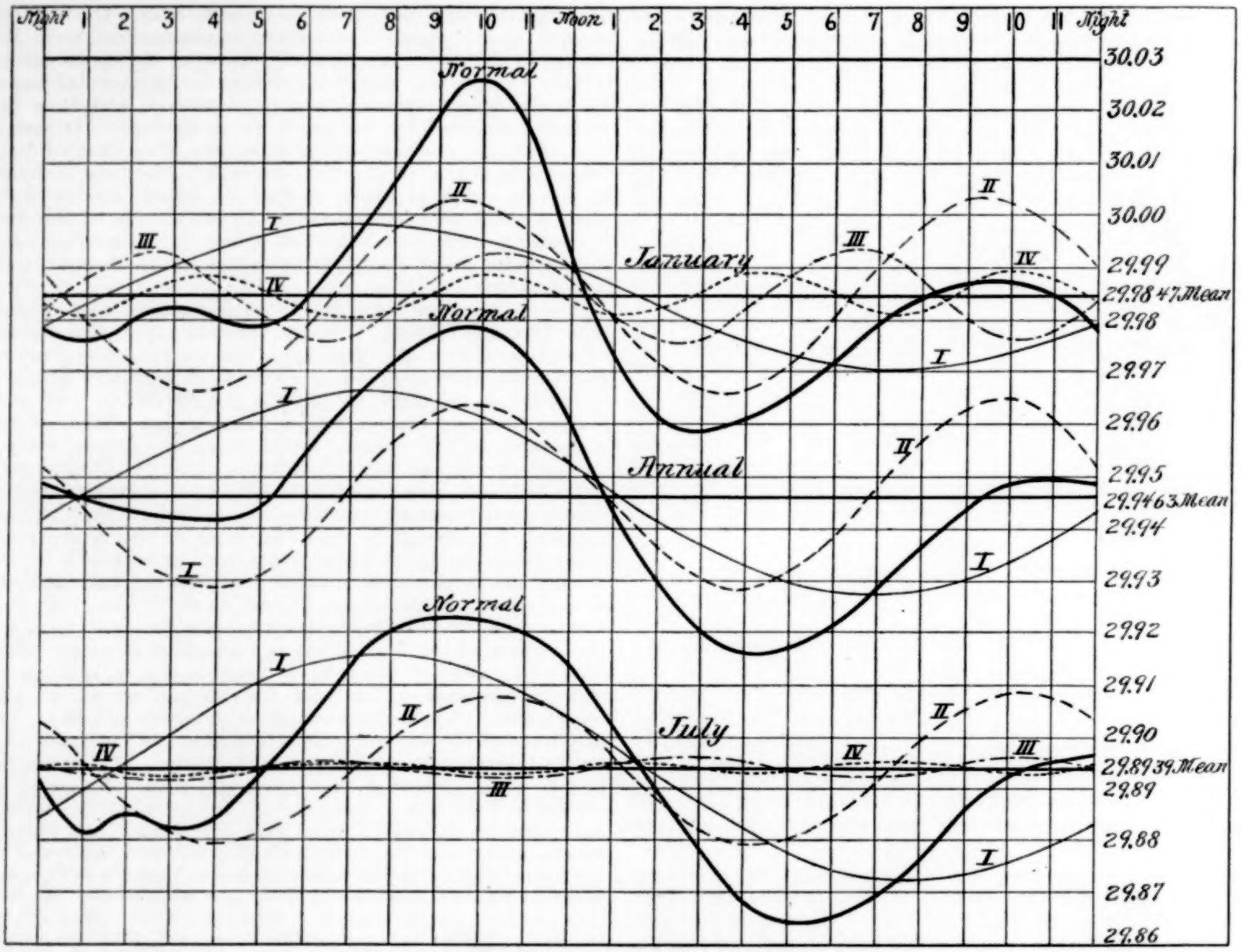

FIG. 1.—The diurnal barometric curve at Washington, D. C.

obtained for a year and the resulting curve analyzed. The amplitudes and epochs of the first four components were as follows, epochs being reckoned from the moon's culmination:

P_1 .00018	P_2 .00092	P_3 .00044	P_4 .00002
M_1 5 h. 35 m.	M_2 0 h. 33 m.	M_3 6 h. 11 m.	M_4 3 h. 58 m.

It will be noted that the second component is the only one that seems to have a real value, but its amplitude is very small. A solar atmospheric tide would have a still smaller amplitude, and while it probably exists, would exert a scarcely appreciable effect upon the barometer. A gravitational explanation of the second component being unsatisfactory, we are forced to consider this component as a thermal effect, brought about in a manner difficult to understand, possibly thru radiation from the upper strata of the atmosphere or thru a vertical movement of the air.

The amplitude of the third component shows a double oscillation, being greatest in winter and summer and least in spring and autumn. This is not real, however, but is due to the fact that this component changes its phase at the equinoxes, the summer maxima falling at the hour of the winter minima. There is really a single variation with a range of from .0085 in winter to .0023 in summer. The epoch occurs about 2 a. m. in winter and about 6 a. m. in summer. It seems to be connected in some way with the annual movement of the sun in latitude.

The fourth component also has its greatest amplitude in winter and its least in summer, the annual variation being from .0042 to .0004. Its phase changes rapidly from month to month, the epoch in winter being about 4 a. m. and in summer about 7 a. m., making a reversal of phase, so that the summer maxima fall at the time of the winter minima. At other stations this same peculiarity appears, and there is a much greater amplitude in winter than in summer. Altho it is exceedingly difficult to assign any physical cause for this component, its characteristics are such that we can not regard it as the result of purely accidental fluctuations.

Components of higher order than the fourth may be obtained by analysis of the diurnal curve, but they are of less amplitude and greater irregularity than the first four, and there is little to indicate that they have any physical significance. It is possible that further study of the first and second components may prove these to be the only ones that are real. The invention of some method that will take into account in calculation the nature, time, and effect of the causes of the first two may reduce the higher components to negligible quantities and show that their appearance may be due to the fact that our present methods of harmonic analysis can not well take into account causes operating thru periods incommensurable with twenty-four hours, nor allow for effects varying except as cosine curves.

FORECASTS AND WARNINGS.

By Prof. A. J. HENRY, temporarily in charge of Forecast Division.

Stormy weather prevailed over the north Atlantic during the greater part of November, the periods of severe weather being from the 4th to 9th and 18th to 25th and again on the 30th. For the greater portion of this time gales were particularly severe along the coasts of the Canadian Maritime Provinces as well as on the British coast. The storm which past off the Newfoundland coast on the 18th was experienced on the 21st at the Azores, where it raged continuously for two days. It appears not to have reached European shores. At the close of the month a severe storm was passing eastward over the western Atlantic, pressure being below 29.00 inches at St. Johns, N. F. The period November 15–25 was productive of continuous gales and stormy weather, especially over the track of vessels between the Mediterranean and New York.

In the first decade of the month no storm of importance traversed the United States east of the Rocky Mountains; in the North Pacific coast States, however, the weather was very stormy, with almost incessant rains. The rivers and small streams in Washington west of the Cascade Range overflowed their banks between the 9th and 15th and caused an immense amount of damage. The greatest loss was sustained in the district between Puget Sound and the Columbia River. In this region the rivers became raging torrents, overflowed their banks, and converted the lowlands into inland seas. The total loss as estimated by newspapers was over $2,000,000.

In the second decade of the month a storm of more than ordinary severity in some portions of its path crost the United States. It reached the north Pacific coast on the evening of the 14th; it was attended by high southerly gales and heavy rains in Oregon and Washington, which continued uninterruptedly for about twenty-four hours. Two days after striking the coast the storm formed an irregular shaped depression extending from North Dakota southeastward to Iowa and thence southwestward to western Arkansas. This depression was separated into two portions during the next twelve hours, the northern portion remaining almost stationary in North Dakota for thirty-six hours and then moving northeastward as a storm of little strength. The southern portion of the original depression was evidently forced to southern Texas by a strong rise in pressure over the eastern Rocky Mountain slope. It occupied southern Texas from the morning of the 17th until the night of the 19th and then moved northeastward, developing great strength over the upper Lakes on the night of the 21st. While this storm occupied southern Texas it seemed to be continually fed by secondary developments over Arizona and New Mexico which moved southeastward and merged in the general area of low pressure over Texas. As the area of high pressure advanced in the rear of these secondary developments extremely cold weather for the season was experienced in New Mexico and western Texas, and snow fell for more than twenty-four hours. The snow was attended by strong winds and very low temperatures. Five persons are known to have perished from exposure to the storm and the loss of live stock, especially sheep and goats, was considerable.

The last decade of the month was characterized by high pressure over the north Pacific coast and thence southeastward into the middle Mississippi Valley, thru which several lows that developed in the extreme Southwest seemed unable to pass.

BOSTON FORECAST DISTRICT.

The month, as a whole, was quite pleasant, altho there was much cloudy, unsettled weather. While precipitation occurred on an average of nine days, the monthly average, 2.58 inches, was 1.58 inches below the normal. The first half of the month was cooler than the average, and the latter half generally warmer than usual. The result was a mean temperature of 37.3°, which is 0.6° below the normal. The only severe storm during the month was that of the 15-16th. It moved northward along the coast causing general heavy precipitation, rain in southeastern sections and snow elsewhere, with strong easterly gales of almost hurricane force on the coast and over the ocean. All shipping was delayed from twenty-four to thirty-six hours by the storm, several small vessels were wrecked, and several lives lost along the coast. Ample and timely warning was issued in advance of the storm. Storm warnings were also issued on the 11th.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month, as a whole, was mild. The temperature was above normal, except in the panhandle of Texas. Precipitation was excessive over western Texas and eastern Arkansas, and was generally deficient elsewhere.

Snow occurred over Oklahoma, western Texas, and the northern portion of eastern Texas at the close of the second decade; it was generally covered by the forecasts. Frost or freezing temperature warnings were issued for portions of the district on five dates, and frost or freezing temperature occurred in some instances over the territory covered by the forecast, and, in other instances, as a result of sluggish movement of the disturbances, the warnings were not verified over the entire area covered by them.

Cold-wave warnings were issued on the 19th for Arkansas, northwestern Louisiana, and portions of eastern Texas. The warnings were verified in Texas, but, owing to the unusually sluggish movement of a low pressure area over southern Texas, the cold wave did not reach Shreveport, La., and Arkansas points.

No severe weather conditions occurred to any great extent without warnings.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISRICT.

The weather conditions were largely controlled, up to the 10th, and after the 21st, by moderate high-pressure areas which gave generally fair weather, with moderate temperatures. The first disturbance of the month past over the district the 10–11th, and was attended by rain and thunderstorms, followed closely by much lower temperature. From the 13th to the 21st, inclusive, three general disturbances moved over the central valleys, the first two from the Rocky Mountain section, and the last from the western Gulf. The first of these gave rain or snow over the district, the second heavy rains, and the third generally excessive rains, causing floods in the smaller rivers, resulting in a great amount of damage. Abnormally high temperatures were registered on the 8–9th and on the 20th–21st. There were no unusually low temperatures and only one moderate snowstorm. No cold wave or special warnings were required.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.

The month was uneventful in this forecast district, with the exception of the storms which past over the Lake region during the latter portion of the month. The one of the 16th and 17th approached from the southwest, but did not attain great force until it reached the western Lake region. During the day and night of the 16th the barometer fell rapidly at the storm center, and high winds were general over the Lakes; storm warnings were ordered in advance on the 16th. Storm warnings were ordered on the 21st for a disturbance which approached the Lake region from the western Gulf section, and past across the western upper Lake region, turning thence eastward down the St. Lawrence Valley. This storm was not so severe as the previous one, but justified ordering warnings at all stations. Still another disturbance approached the Lake region from the southwest and had past the lower Lake region by the morning

of the 27th. Warnings were hoisted at Chicago on the evening of the 25th, and were extended over the balance of the upper Lakes on the morning of the 26th. Verifying velocities were reported at several stations. Warnings were again ordered on the evening of the 29th for a disturbance of slighter energy which approached the Lake region from the British Northwest.

There were no snowstorms of consequence in any portion of the district during the month, and the temperature generally remained moderate, but cold-wave warnings were ordered for the Dakotas, Kansas, and Nebraska on the 16th, in advance of the cold weather following the first storm mentioned in the preceding paragraph. These warnings were verified in the northern sections, but the temperature over Kansas did not fall quite as low as was anticipated.—*Frank H. Bigelow, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

The month was colder than usual thruout the district, with an excess of precipitation in south-central Colorado and north-central New Mexico. In the extreme southern part of New Mexico the excess was the greatest on record for November. A cold wave visited the eastern slope on the 17th. No unusually low temperatures were experienced in the northern part of the Plains region, but south of the Arkansas-Platte divide there was a continuous fall for several days, zero, or lower, being reached in the extreme southeastern part of New Mexico.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month was usually dry, not more than half the normal rainfall being reported; few storms appeared on the northern coast or extended southward. Ordinarily November marks the beginning of the stormy period on the north Pacific coast, but this year the pressure distribution has been unfavorable for the normal storm movement. On the other hand, there has been a tendency for depressions forming over lower California and northwestern Mexico to move slowly northward over the Valley of the Colorado, with little, if any, easterly component of motion. In other words, there have been several cases where the disturbances appeared to be blocked in their eastern progress.

The month began with a disturbance on the Oregon coast which developed into a storm of marked energy. This caused high southeast winds and rain north of Point Conception. The storm was quite severe on the northern coast; warnings were displayed in ample time.

From November 5 to 14 the weather was clear and warm in California, under the influence of a succession of slow-moving high areas. During the latter half of the second decade unsettled weather prevailed, due to the passage of northern lows. During the third decade cold weather, with heavy frosts in the mornings, was reported generally in northern California. In southern California there was a succession of low areas, which apparently made but little progress eastward. High northerly winds resulted in the great Valley of California and along the coast. On November 30 a maximum wind velocity of 63 miles per hour from the northeast occurred at San Francisco. This is the highest wind velocity from the north which has ever been reported in this city.

Frosts have been unusually numerous for the month of November, notwithstanding high winds and dry conditions.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

The first half of November was very stormy, and this district was visited by a succession of gales of unusual severity. Timely warnings were displayed in each case. The only casualty that occurred was the stranding just south of the mouth of the Columbia River of the British bark *Galena* on November 13. No lives were lost when this ship was wrecked, and the cause of the disaster was not so much on account of high winds as it was from fog and strong currents, whereby the navigating officer lost his reckoning and got into the breakers when he thought he was several miles away from them. A similar casualty occurred on October 25 (not previously reported) to the British bark *Peter Iredale*, which was wrecked on Clatsop spit during thick weather. No lives were lost, but the vessel became a total wreck.

The rains attending the storms of the fore part of the month were unusually heavy, especially in Washington, and all streams in that State between the 9th and 15th overflowed their banks and flooded the lowlands. The damage from floods was enormous, and it was several days before traffic was resumed over the railroads. Three or four lives were lost and large quantities of saw logs were swept away from their booms and never recovered. Many bridges, both railroad and county, were destroyed, and the damage in farming communities to fences, stock, and buildings was very great. In Oregon the rains were not so heavy; the rivers only became bank full, and little damage ensued. The last half of the month was generally fair and cooler with moderate but disagreeable east winds.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The only great flood of the month occurred in the North Pacific States, and mainly over the watersheds of the smaller streams where no river and flood service is maintained. The details regarding these floods were fully covered in the public press, and a brief mention of them is made in another part of this REVIEW. They were caused by the excessive rains during the first decade of the month, accompanied by high temperatures which rapidly melted the several feet of snow already on the mountain ranges.

The rise in the Columbia River was only moderate, but in the Willamette it was more pronounced, altho flood stages were reached only in the vicinity of Portland, Oreg., where a stage of 16 feet, or one foot above the flood stage, was reached on the 18th.

There were no other floods of consequence except in the Tennessee River. This flood was caused by the heavy snows of the 14th and 15th, the high temperatures of the 15th causing the rapid melting of the snows, together with the heavy rains from the 17th to the 19th, inclusive. At many places along the upper Tennessee River the stages reached exceeded all previous records for the month of November, and considerable damage was done by the rising waters. The following report on the flood over this portion of the Tennessee watershed was prepared by Mr. L. M. Pindell, official in charge of the local office of the Weather Bureau at Chattanooga, Tenn.:

On November 14 and 15 heavy snows prevailed over the entire Tennessee watershed from central Tennessee to Virginia. The snow varied in depth from 4 to 8 inches, and was the heaviest on record for the month of November. The ground was frozen and comparatively dry, and very little of the snow melted on the 14th. On the 15th the temperature began to rise, and the melting snow moistened the ground almost to the point of saturation. Rain began on the 17th, became heavy during the same evening, and continued until the 19th. A report for the 19th from Murphy, N. C., on the headwaters of the Hiwassee River, delayed twenty-four hours in transmission, stated that 8 inches of rain had fallen. McGhee, Tenn., on the Little Tennessee River, reported 4.74 inches, and Rogersville, Tenn., on the Holston River, 3.62 inches during the twenty-four hours ending at 8 a. m. of the 19th. All the precipitation that had fallen was finding its way into the river and tributaries. A careful study of the conditions justified a forecast of 25 feet at Chattanooga, Tenn., by the night of the 20th. At 7 a. m. of the 19th, the Clinch River had risen over 12 feet at Speers Ferry, Va., and was within 4.5 feet of the flood stage; an 18-foot rise was reported at McGhee, on the Little Tennessee, making the river over 2 feet above the flood stage, and a nearly 17-foot rise at Charleston, Tenn., on the Hiwassee, or within 2 feet of the flood stage. The rise at Clinton, Kingston, Tazewell, Knoxville, and Loudon, Tenn., varied from 7 to 8 feet.

Warnings of the sudden rise were promptly issued and given wide distribution, with the result that large quantities of lumber and other

property were secured and protected. Heavy rises occurred between 7 a. m. of the 19th and 7 a. m. of the 20th, varying from 14 feet at Chattanooga to 11 feet on the Clinch and Powell rivers. A stage of 32 feet was forecast for Chattanooga by the night of the 21st, and the information widely disseminated. Local interests were warned to prepare for a crest stage of a little over 33 feet during the night of the 21st. Numerous calls by telephone from parties up and down the river were promptly answered and full information and forecast given. A crest stage of 23 feet was forecast at Bridgeport, Ala., and 29 feet at Guntersville, Ala.; the actual crests were 23.4 feet at Bridgeport, 0.6 foot below the flood stage, and 29.8 feet at Guntersville, 1.2 feet below the flood stage. The river at Chattanooga reached its crest of between 33.3 and 33.4 feet after 12:35 a. m. of the 22d, and the first fall was recorded at 12:20 p. m. of the 22d. The crest stage exceeded all previous November records by a little over 3 feet. The back water caused considerable inconvenience at and below Chattanooga by covering public roads and by stopping various sawmills and other industries near the river. No property was lost, as far as can be ascertained, at or below Chattanooga. Above Chattanooga, on the headwaters of the Ocoee and Hiwassee rivers, much damage was done. Thousands of bushels of corn were damaged and pumpkin fields were completely washt away. The drift that passed Chattanooga was heavy, consisting of logs, pumpkins, large trees, straw, bridge timber, dead hogs, chickens, etc. The Louisville and Nashville Railway bridge at Reliance and the Isabella trestle were washt away on the afternoon of the 19th. A cloud-burst on the afternoon of the 18th on Thunderhead Mountain washt away about 25 miles of track of the Little River Lumber Company, near Townsend, causing a loss of nearly $50,000. The Philadelphia Veneer and Lumber Company lost $8,000 worth of logs at Clinton, Tenn., and the Tellico Lumber Company, at Tellico Plains, lost a large number of logs. It was reported that twenty lives were lost at McCays station, on the Knoxville and Marietta branch of the Louisville and Nashville Railway, but later information reduced that number to three. The persons lost were warned to move, as the river was rising rapidly, but they paid no attention to the warning, and within three hours they were swept away, with their cabin.

Warnings were also issued at the proper time for the lower Tennessee River, where the crest stages varied from 1 foot to 4 feet above the flood lines.

The crest of the Ohio River rise reached Cairo, Ill., on the 27th, and at the end of the month the Mississippi was rising steadily below Memphis, Tenn. In the vicinity of Paducah, Ky., the high water caused damage to the amount of about $50,000, altho the highest point reached by the river was over 7 feet below the flood stage. The losses were due to the fact that the rise was a most unusual one for the month of November, when low-water stages are the rule, and much stock and lumber had accordingly been left on the lands subject to overflow. It has been stated, however, that the losses would have been more than doubled had it not been for the warnings issued in advance of the flood.

The Milk River at Havre, Mont., froze over on the 15th and the James at Huron, S. Dak., on the 17th. The Missouri was still open at the end of the month from Bismarck, N. Dak., southward, altho heavy floating ice was observed at Bismarck on the 18th. There was a small gorge at Sioux City, Iowa, on the 20th, and floating ice as far south as Kansas City, Mo., from the 22d to the 28th, inclusive.

The first ice in the Mississippi River was observed at Fort Ripley, Minn., on the 17th. Floating ice was also seen on the 23d at Prairie du Chien, Wis., but none below that point.

The highest and lowest water, mean stage, and monthly range at 281 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure for November, 1906, over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

The mean atmospheric pressure was above the normal over all sections of the United States and Canada except the extreme southwest, along the Gulf coast, and over New England and the Canadian Maritime Provinces.

Over the interior portion of the United States from the Rocky Mountains eastward, pressure averaged unusually high, due in the main to the slow passage eastward of several well-defined areas of high pressure during the early part of the month. Pressure averages for the month were decidedly below the normal, —.05 to —.15 inch, from New England northeastward over New Brunswick and Nova Scotia.

Over the north Pacific coast and adjacent territory the almost continuous low pressure during the early part of the month gave way during the second decade, and unusually high pressure prevailed over that section during the remainder of the month.

TEMPERATURE.

From the Rocky Mountain slope eastward to the Atlantic the monthly mean temperature averaged above the normal, except over eastern New York and northern New England, where slight deficiencies were noted. Over the lower Mississippi Valley the excess of temperature was marked, averaging about 5° daily above the normal in the southern portions of the States of Alabama, Mississippi, and Louisiana.

Temperatures along the northern border were generally above the average, especially over the upper Lake region, and under the influence of the prevailing southerly winds from the high pressure over the central part of the United States the positive departures in Canada from the Lake region to Manitoba and northward showed marked increases.

From the Rocky Mountains west to the Pacific coast, except over small sections of northern California and western Oregon, the temperature was generally below the seasonal average. Over southwestern Utah, southern Nevada, and southeastern California, the month was an unusually cold one.

Maximum temperatures of 90°, or above, were recorded in southwestern Arizona and southeastern California and over the southern portion of Texas. Maximum temperatures of 80° to 90° were confined principally to the Gulf States.

Severe cold was experienced over the lower Mississippi Valley and east Gulf States from the 12th to the 14th, and freezing temperatures prevailed over the interior of that section with killing frosts almost to the Gulf coast. Unusually cold weather prevailed over California during the latter part of the month with heavy to killing frosts in many portions of the southern part of the State.

Minimum temperatures from 10° to 25° below zero were recorded over North Dakota and in the central Rocky Mountain districts during the progress of an extensive area of high pressure southeastward over the Great Plains and central valleys from the 18th to the 20th.

PRECIPITATION.

The precipitation during November is usually heavy, above 4 inches, over the lower Mississippi Valley, and on the Pacific coast from central California northward over the district west of and including the Coast Range of mountains, and, including the higher elevations of the Cascades, where monthly amounts from 10 to 15 inches are frequently recorded.

Precipitation is usually light, less than 1 inch, over southern California, the Rocky Mountains, and the Great Plains, and comparatively light over the Florida Peninsula.

During November, 1906, normal conditions over southern Florida were reversed and the heaviest rainfall ever recorded in November, 10.82 inches, was measured at Key West. Nearly all of the above amount, 10.30 inches, occurred from the 1st to the 3d, during the prevalence of a slight barometric depression apparently central over western Cuba. Over the central Mississippi Valley precipitation was also far in excess of the average. The amount of fall over western Tennessee, northern Mississippi, and northeastern Arkansas from the 16th to 20th was at many points the heaviest ever recorded. Much damage was done by floods in the small streams, which in many cases were higher than ever known previously.

Over the north Pacific coast the rainy season, which began unusually early in September, continued thru October, and rainy weather was almost continuous from the 2d to the 21st of November. During the latter period the fall, especially on the western slopes of the Coast Range and the higher elevations of the Cascade Mountains, was unusually heavy. At Glenora, Oreg., a station on the western slope of the Coast Range of Mountains, at an elevation of about 2500 feet, the amount of fall from the 1st to the 20th reached the remarkable depth of 38.73 inches.

On account of the heavy rainfall during September and October the ground over the headwaters of the streams in the Coast and Cascade mountains was already thoroly saturated and the streams were bank full, so that the additional fall during November caused serious floods in all streams having their sources in the above-mentioned mountains.

Precipitation was also generally in excess of the normal over the upper Lakes, the upper Mississippi Valley, the area drained by the Missouri River, the mountain and plateau regions, and was unusually heavy over western Texas and eastern New Mexico. Over nearly all districts from the lower Lakes to the Atlantic coast and south to central Florida and the Gulf coast regions, except northern Mississippi, northeastern Arkansas, and the extreme southern coast of Texas, the precipitation for the month was unusually light. Less than 50 per cent of the normal occurred over all sections near the coast from New England to Florida and over nearly the entire Gulf region.

Over all of California precipitation was largely deficient.

SNOWFALL.

The total snowfall was generally not above the average, but the extent of territory over which snow occurred was unusually large, measurable amounts being reported from all districts except comparatively small areas near the south Atlantic, Gulf, and Pacific coasts. Over the southern Rocky Mountains snowfall was generally heavy, most of it occurring during the prevalence of an area of low pressure over that section from the 17th to 19th. The fall was especially heavy in eastern New Mexico and western Texas, where depths from 12 to 18 inches were general. High winds and severe cold weather immediately following drifted the snow badly and caused much suffering and some loss to animal life.

Rather heavy snowfall occurred in the northwest quadrant of the low area that moved from Texas to New England from the 14th to the 16th, the depth over parts of Pennsylvania, New York, northern New Jersey, and the interior of New England ranging from 5 to 10 inches. Heavy snows also occurred over Missouri and adjacent territory on the 14th, the amount of fall ranging from 3 to 12 inches, a very unusual depth so early in the winter.

At the end of the month but little snow remained on the ground except over interior New England, the northern portions of Michigan, Wisconsin, Minnesota, and North Dakota, and over the Rocky Mountain region.

RELATIVE HUMIDITY.

Relative humidity was deficient over the Atlantic, Gulf, and Pacific districts, but was largely in excess of the normal in all portions of the mountain and plateau districts. Over Colorado, western Texas, New Mexico, Arizona, and Utah, the humidity averaged from 10 to 16 per cent above the normal. Cloudiness was also much in excess of the normal over the last-named region.

As a rule, the month was one of much pleasant weather over all eastern districts, where the usual outdoor occupations were pursued with little interruption, while from the Mississippi westward much cloudy and inclement weather prevailed.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	9	39.4	− 0.6	+ 7.2	+ 0.7
Middle Atlantic	13	46.2	+ 1.3	+13.1	+ 1.2
South Atlantic	10	55.1	+ 1.0	+ 5.2	+ 0.5
Florida Peninsula *	8	68.0	+ 1.4	+ 2.0	+ 0.2
East Gulf	8	58.7	+ 3.0	− 3.6	− 0.3
West Gulf	7	57.6	+ 1.3	− 3.5	− 0.3
Ohio Valley and Tennessee	12	46.0	+ 1.4	+ 4.8	+ 3.4
Lower Lake	8	39.6	+ 0.6	+14.0	+ 1.3
Upper Lake	10	36.5	+ 2.6	+22.1	+ 2.0
North Dakota *	8	26.0	+ 2.7	+25.0	+ 2.3
Upper Mississippi Valley	13	38.1	+ 1.3	+ 8.4	+ 0.8
Missouri Valley	11	37.3	+ 0.5	+10.3	+ 0.9
Northern Slope	7	31.6	− 1.2	+ 9.1	+ 0.8
Middle Slope	6	40.8	− 0.5	− 1.9	− 0.2
Southern Slope *	6	46.2	− 2.8	−17.7	− 1.6
Southern Plateau *	13	46.2	− 1.2	− 1.1	− 0.1
Middle Plateau *	8	35.1	− 2.1	− 3.0	− 0.3
Northern Plateau *	12	35.3	− 0.3	+17.6	+ 1.6
North Pacific	7	45.5	+ 0.1	+13.7	+ 1.2
Middle Pacific	5	53.1	− 0.4	+12.1	+ 1.1
South Pacific	4	56.3	− 1.3	+ 8.2	+ 0.7

* Regular Weather Bureau and selected cooperative stations.

In Canada.—Prof. R. F. Stupart says:

The mean temperature of November was higher than the average from Saskatchewan to Lake Huron, and either average or about 1° above or below in other portions of the Dominion. The largest positive departure, amounting to 7°, occurred in Manitoba and to the northward of Lake Superior.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	9	2.65	69	−1.2	−2.3
Middle Atlantic	13	1.68	53	−1.5	+0.4
South Atlantic	10	0.95	33	−1.9	−3.7
Florida Peninsula *	8	2.29	105	+0.1	+4.5
East Gulf	8	1.60	46	−1.9	+0.5
West Gulf	7	2.46	65	−1.3	−8.0
Ohio Valley and Tennessee	12	4.31	116	+0.6	−3.5
Lower Lake	8	2.19	69	−1.0	−2.8
Upper Lake	10	3.20	123	+0.6	−1.6
North Dakota *	8	1.53	184	+0.7	+2.1
Upper Mississippi Valley	13	3.11	147	+1.0	−0.4
Missouri Valley	11	1.43	116	+0.2	+1.3
Northern Slope	7	0.89	182	+0.4	+3.1
Middle Slope	6	1.31	144	+0.4	+2.6
Southern Slope *	6	2.51	156	+0.9	+4.8
Southern Plateau *	13	1.54	241	+0.9	+3.6
Middle Plateau *	8	1.27	190	+0.6	+4.4
Northern Plateau *	12	2.35	131	+0.6	−0.3
North Pacific	7	8.54	123	+1.6	−5.3
Middle Pacific	5	1.54	47	−1.7	+0.8
South Pacific	4	0.82	62	−0.5	+5.3

* Regular Weather Bureau and selected cooperative stations.

In Canada.—Professor Stupart says:

The precipitation was very generally in excess of the average from Manitoba westward to the Pacific and also in the Maritime Provinces, while in Ontario and Quebec it was deficient in most districts. Near the coast in British Columbia it was almost wholly rain, and in the upper mainland it was part rain and part snow. In the western provinces it was almost wholly snow. In Ontario, Quebec, and the Maritime Provinces it was part rain and part snow, the former preponderating.

At the close of the month all the higher lands of British Columbia and the whole of the western provinces, exclusive of southern Alberta, were snow covered, with fair sleighing in many districts. In Ontario the ground was mostly bare, except in Algoma and Nipissing, and in some localities near the Ottawa River and in Quebec there was but a thin

covering, as was also the condition in some portions of Nova Scotia and Prince Edward Island.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	72	— 6	Missouri Valley	73	+ 2
Middle Atlantic	71	— 4	Northern Slope	76	+ 9
South Atlantic	74	— 4	Middle Slope	72	+10
Florida Peninsula	80	— 1	Southern Slope	78	+16
East Gulf	73	— 3	Southern Plateau	56	+11
West Gulf	73	— 1	Middle Plateau	66	+ 9
Ohio Valley and Tennessee	73	0	Northern Plateau	74	+ 2
Lower Lake	78	+ 1	North Pacific	84	0
Upper Lake	81	+ 1	Middle Pacific	67	— 7
North Dakota	84	+ 5	South Pacific	61	— 6
Upper Mississippi Valley	78	+ 4			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.4	+ 0.8	Missouri Valley	6.4	+ 1.4
Middle Atlantic	4.5	— 0.7	Northern Slope	5.8	+ 1.2
South Atlantic	3.2	— 1.3	Middle Slope	5.6	+ 2.0
Florida Peninsula	4.3	— 0.3	Southern Slope	5.7	+ 2.4
East Gulf	4.0	— 1.4	Southern Plateau	3.6	+ 1.0
West Gulf	5.1	+ 0.5	Middle Plateau	5.7	+ 1.7
Ohio Valley and Tennessee	5.7	0.0	Northern Plateau	7.1	+ 1.4
Lower Lake	7.1	— 0.1	North Pacific	7.6	+ 0.8
Upper Lake	7.6	+ 0.6	Middle Pacific	4.0	+ 0.2
North Dakota	6.5	+ 1.2	South Pacific	2.9	0.0
Upper Mississippi Valley	6.9	+ 1.6			

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Block Island, R. I.	11	54	e.	Nantucket, Mass.	15	59	e.
Do	15	61	ne.	New York, N. Y.	16	51	w.
Do	16	50	nw.	North Head, Wash.	2	59	se.
Buffalo, N. Y	21	58	sw.	Do	3	52	se.
Do	22	70	sw.	Do	4	72	se.
Do	27	54	w.	Do	5	60	se.
Canton, N. Y.	22	53	sw.	Do	6	87	se.
Cheyenne, Wyo	15	60	nw.	Do	9	68	se.
Chicago, Ill	21	59	sw.	Do	10	67	se.
Cleveland, Ohio	21	52	sw.	Do	11	54	se.
Do	26	50	w.	Do	12	72	se.
Columbus, Ohio	21	56	sw.	Do	14	64	s.
Detroit, Mich	21	50	sw.	Do	15	67	nw.
Eastport, Me	12	60	e.	Do	25	56	nw.
Do	15	53	e.	Point Reyes Light, Cal	3	57	s.
Do	16	61	e.	Do	4	60	s.
El Paso, Tex	17	50	w.	Do	16	60	nw.
Fort Smith, Ark	16	50	w.	Do	17	76	nw.
Grand Haven, Mich	21	64	sw.	Do	18	58	nw.
Grand Rapids, Mich	21	66	sw.	Do	21	62	nw.
Green Bay, Wis	21	50	n.	Do	22	54	ne.
Helena, Mont	10	50	sw.	Rapid City, S. Dak	29	50	w.
Indianapolis, Ind	21	58	sw.	Salt Lake City, Utah	15	66	nw
Milwaukee, Wis	16	55	se.	San Francisco, Cal	30	64	ne.
Mount Tamalpais, Cal	2	50	s.	Southeast Farallon, Cal.	18	51	nw.
Do	4	52	w.	Tatoosh Island, Wash	4	58	s.
Do	17	66	nw.	Do	5	53	s.
Do	18	62	n.	Do	8	52	e.
Do	22	67	n.	Do	9	68	s.
Do	23	54	n.	Do	10	51	e.
Do	26	60	n.	Do	12	69	s.
Do	30	70	ne.	Do	14	55	sw.
Mount Weather, Va.	12	50	nw.	Do	15	61	nw.
Do	13	52	nw.	Toledo, Ohio	21	68	sw.
Do	27	56	nw.	Do	22	50	sw.
Do	28	56	nw.				

CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

TEMPERATURE AND PRECIPITATION BY SECTIONS, NOVEMBER, 1906.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	55.8	+ 2.6	3 stations	87	18, 19	Riverton	19	12	2.50	—0.48	Cedar Bluff	4.83	Flomaton	0.30
Arizona	51.8	— 1.1	Vail	98	12	Flagstaff (a)	— 8	25	1.49	+0.39	Natural Bridge	3.60	Parker	0.20
Arkansas	50.2	— 0.4	Conterpoint	88	16	Pond	13	22	5.90	+2.30	Helena (No. 2)	19.56	Fort Smith	2.09
California	51.4	— 1.2	Craftonville	105	12	Bodie	—12	19	1.92	—0.96	Monumental	13.27	Mammoth Tank	0.00
Colorado	34.1	— 1.2	Holyoke Las Animas	79 79	9 8	Antelope Springs	—28	26	1.04	+0.31	Wagon Wheel Gap	3.53	Cripple Creek	0.16
Florida	66.3	+ 1.0	Orange City	92	19	De Funiak Springs Wausau	25 25	13 13	1.16	—1.01	Key West	10.82	4 stations	0.00
Georgia	55.2	+ 1.0	Screven	88	22	3 stations	19	13, 14	1.71	—0.84	Ramsey	8.68	St. George	T.
Hawaii	72.2†	....	Waialua Mill, Oahu	91	9	Humuula, Hawaii	36	26	7.99‡	....	Nahiku, Maui	25.90	Kaanapali, Maui	0.92
Idaho	34.0	— 1.3	Hotspring	73	8	Forney	—13	19	2.56	+0.51	Murray	7.96	Garnet	T.
Illinois	40.4	— 0.1	Carrollton	78	5	Lanark	8	23	3.91	+1.28	New Burnside	8.33	La Harpe	1.15
Indiana	41.9	+ 0.5	Rome	78	20	Laporte	2	15	4.09	+0.33	Rome	6.92	Hammond	2.02
Iowa	35.4	+ 0.2	3 stations	76	6	Woodburn	— 5	22	2.03	+0.72	Preston	3.86	Washta	0.35
Kansas	41.4	— 1.0	Paola	81	10	Hugoton	— 8	21	1.94	+0.97	Fredonia	5.28	Lebanon	T.
Kentucky	46.1	— 0.1	St. John	89	6	Shelby City	11	14	5.02	+1.68	Leitchfield	12.09	Richmond	2.19
Louisiana	61.8	+ 3.3	Schriever	90	18	Covington Liberty Hill	25 25	13 13	2.90	—0.84	Farmerville	9.35	Morgan City	0.24
Maryland and Delaware	45.3	+ 1.1	Westernport, Md	78	21	Deer Park, Md Oakland, Md	15 15	3, 6 7	1.50	—1.11	Annapolis, Md	2.95	Westernport, Md	0.65
Michigan	36.8	+ 1.2	Harbert	70	6	Humboldt	— 1	14	3.20	+0.51	Ishpeming	5.93	Plymouth	1.30
Minnesota	30.7	+ 1.8	New Ulm	71	6	Bagley, Detroit	—16	20	1.82	+0.74	Two Harbors	4.15	Worthington	T.
Mississippi	56.8	+ 2.0	Aberdeen Magee	89 89	17 19	Ripley	18	13	3.71	+0.57	Austin	19.78	Quitman	0.58
Missouri	42.7	— 1.6	Windsor	88	7	Bethany	— 3	27	2.60	+0.75	Caruthersville	10.07	Dean	1.13
Montana	29.8	— 1.2	Huntley	72	13	Grayling	—19	23	1.59	+0.38	Saltese	8.40	Decker	T.
Nebraska	36.3	+ 0.3	Bridgeport	78	13	Agate	— 7	20	0.64	0.00	Rulo	2.20	4 stations	0.00
Nevada	35.4	— 4.0	Logan	83	11	Geyser	—22	29	0.93	+0.14	Palmetto	5.60	Wabuska	0.10
New England*	37.3	— 0.6	Norfolk, Mass	70	18	Millinocket, Me	0	28	2.58	—1.54	Rockport, Mass	4.68	Houlton, Me	1.20
New Jersey	43.6	+ 0.3	Toms River	70	19	Layton	8	17	1.61	—1.75	Atlantic City	2.52	South Orange	1.06
New Mexico	40.9	— 1.0	Monument Socorro	86 86	10 5	Tres Piedras	—12	20	1.38	+0.69	Roswell	4.06	Vermejo	0.20
New York	36.7	— 0.3	Watertown	71	18	Indian Lake	0	15	2.27	—0.74	Griffin Corners	4.81	Scarsdale	1.00
North Carolina	50.6	+ 1.2	3 stations	85	19, 20	Pink Beds	6	16	1.83	—1.15	Murphy	9.27	Pinehurst	0.04
North Dakota	23.8	+ 3.0	Amenia Buford	68 68	3 4	4 stations	—16	3 dates	1.62	+0.68	Park River	3.94	Beach	0.62
Ohio	41.1	+ 0.2	Ironton	82	20	Hedges	14	16	2.59	—0.46	Bucyrus	4.86	Philo	0.81
Oklahoma and Indian Territories.	46.7	— 2.6	Guthrie, Okla	88	6, 10	Gage, Okla Hooker, Okla	— 5 — 5	21 21	1.78	—0.09	Blackburn, Okla	4.76	Pauls Valley, Ind. T	0.25
Oregon	42.4	— 0.3	Wamic	81	1	Granite	—11	23	7.04	+2.71	Glenora	38.39	Riverside	0.35
Pennsylvania	41.5	+ 1.1	Johnstown	80	21	Dushore	9	30	1.48	—1.61	Somerset	3.08	Harrisburg	0.54
Porto Rico	77.5	....	Central Aguirre Manati	97 97	2 8, 9	Aibonito	55	10	5.51	....	Rio Blanco	9.23	Guanica Central	0.97
South Carolina	53.8	+ 0.1	Blackville	89	9	Greenville	20	13, 14	0.96	—1.84	Walhalla	2.36	Winnsboro	T.
South Dakota	31.7	+ 0.5	Pierre	75	5	White Horse	— 6	20	0.72	+0.15	Elk Point	1.60	Cherry Creek	0.10
Tennessee	48.3	+ 0.4	Sevierville	86	20	Erasmus Hohenwald	12 12	14 13	7.13	+3.42	Bolivar	14.98	Elizabethton	1.83
Texas	55.7	— 0.3	Fort McIntosh	101	17	Plemons	— 9	21	2.01	—0.52	Brighton	6.58	Riverside	T.
Utah	36.1	— 1.6	Thistle	90	2, 4	Plateau	—18	20	1.81	+0.76	Grayson	4.31	Indianola	0.17
Virginia	47.1	+ 0.8	Doswell	82	20	Burkes Garden	12	14	2.19	—0.30	Big Stone Gap (a)	7.00	Randolph	0.25
Washington	39.8	— 0.3	Cheney	70	4	Northport	3	26	7.30	+1.60	Quiniault	24.03	Ephrata	0.74
West Virginia	44.2	+ 1.1	Sutton Weston	84 84	21 20	Pickens	13	1	2.39	—0.73	Princeton	5.50	Harpers Ferry	0.35
Wisconsin	34.2	+ 2.1	Prairie du Chien	70	6	Weyerhaeuser	— 4	20	3.02	+1.52	Stevens Point	4.96	Barron	0.47
Wyoming	29.2	— 1.5	Wheatland	70	12	Soda Butte, Y. N. P.	—26	23	0.87	+0.27	Chugwater	2.05	Barnum	0.02

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † 48 stations, with an average elevation of 720 feet. ‡ 146 stations.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

For description of tables and charts see page 38 of REVIEW for January, 1906.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, November, 1906.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.												Precipitation, in inches.			Wind.									
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Maximum velocity: Direction.	Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
New England.							39.4	— 0.6										72	2.65	— 1.2										6.4	
Eastport	76	69	85	29.83	29.92	— .09	35.7	— 1.0	56	19	40	16	30	31	18	33	30	79	3.56	— 0.7	12	12,342	nw.	61	e.	16	3	3	24	8.5	14.3
Portland, Me.	103	81	117	29.86	29.98	— .06	37.4	— 0.6	59	19	43	18	30	32	22	33	28	72	3.04	— 1.0	12	7,385	nw.	36	ne.	15	9	5	16	6.2	12.5
Concord	288	70	79	29.68	30.00	— .06	36.6	— 0.7	57	19	43	17	15	30	30	....	....	....	2.06	— 1.4	12	4,518	nw.	25	nw.	16	9	6	15	5.9	13.9
Burlington	404	12	47	29.62	30.08	+ .03	33.6	— 4.2	56	19	40	11	30	27	24	....	....	....	2.60	— 0.2	12	7,781	n.	42	s.	22	4	7	19	7.6	21.1
Northfield	876	16	70	29.08	30.06	+ .01	31.5	— 1.4	59	19	39	4	15	24	33	29	26	81	2.53	— 0.6	13	5,648	n.	36	n.	3	4	7	19	7.6	21.2
Boston	125	115	188	29.86	30.00	— .05	41.7	+ 1.1	68	18	48	23	30	35	22	36	30	66	2.55	— 2.0	12	8,210	nw.	39	ne.	11	10	9	11	5.4	1.1
Nantucket	12	14	90	29.96	29.97	— .08	43.8	— 0.9	61	19	49	26	30	38	23	40	36	76	1.84	— 1.7	14	12,595	w.	59	e.	15	8	3	19	7.1	T.
Block Island	26	11	46	29.98	30.01	— .05	44.6	— 0.3	62	18	50	27	30	40	19	40	35	72	2.46	— 1.7	9	15,199	nw.	61	ne.	15	11	7	12	5.5	0.1
Narragansett	....	9	....	....	....	....	41.8	— 1.2	68	19	50	19	30	34	29				3.46	— 0.7	9	......	w.	....	....	..	15	7	8	....	T.
Providence	160	57	67	29.84	30.01	— .06	41.8	— 0.8	68	18	49	22	30	34	26	36	29	65	1.90	......	10	5,486	nw.	26	nw.	16	13	8	9	4.9	1.9
Hartford	159	122	132	29.86	30.04	— .04	41.4	+ 1.2	65	18	48	23	30	34	24	36	30	68	2.90	......	9	4,827	nw.	30	w.	16	7	7	16	6.7	5.2
New Haven	106	116	155	29.91	30.03	— .04	42.8	+ 1.7	65	18	50	24	30	35	25	37	30	67	2.42	— 1.5	9	6,916	nw.	36	n.	15	11	8	11	4.9	3.0
Mid. Atlantic States.							46.2	+ 1.3										71	1.68	— 1.5										4.5	
Albany	97	102	115	29.97	30.08	.00	38.6	— 0.6	58	19	45	21	30	32	27	34	30	77	2.46	— 0.5	13	5,510	nw.	26	w.	23	7	9	14	6.4	10.4
Binghamton	875	79	90	29.15	30.10	+ .01	37.6	— 0.3	63	18	45	13	30	30	30	....	....	....	1.20	— 0.9	8	4,423	w.	27	w.	22	8	5	17	6.7	8.6
New York	314	108	350	29.72	30.06	— .03	44.9	+ 1.5	64	18	51	27	29	39	25	39	33	65	1.28	— 2.5	4	9,919	nw.	51	w.	16	14	8	8	4.9	T.
Harrisburg	374	94	104	29.71	30.12	+ .01	44.5	+ 2.1	66	18	51	31	17	38	25	39	32	65	0.54	— 2.3	6	5,608	nw.	28	nw.	27	12	6	12	4.8	0.5
Philadelphia	117	116	184	29.97	30.10	.00	47.2	+ 3.3	67	18	54	32	30	40	24	41	34	63	1.72	— 1.5	5	8,002	nw.	36	n.	15	14	6	10	4.6	0.1
Scranton	805	111	119	29.21	30.09	.00	40.4	......	62	18	47	18	17	34	30	36	31	74	2.09	......	12	5,373	nw.	27	sw.	22	8	6	16	6.5	13.0
Atlantic City	52	37	48	30.04	30.10	.00	45.4	+ 0.7	63	19	53	26	30	38	26	40	34	70	2.52	— 1.0	6	6,010	nw.	28	nw.	29	15	5	10	4.6	
Cape May	17	48	52	30.10	30.12	+ .02	46.6	0.0	62	22	52	32	30	41	20	44	....	....	1.42	— 1.9	6	7,239	nw.	....	......	..	14	10	6	4.1	
Baltimore	123	69	117	29.98	30.11	.00	47.3	+ 1.9	65	18	55	32	30	40	23	40	33	62	1.74	— 1.3	5	5,484	nw.	36	w.	27	13	6	11	4.6	T.
Washington	112	59	76	30.00	30.12	.00	47.8	+ 3.3	75	21	57	30	17	38	33	41	36	73	1.63	— 1.2	4	4,216	nw.	26	nw.	28	16	7	7	4.1	0.2
Cape Henry	18	11	58	30.10	30.12	+ .02	51.6	— 0.3	77	19	58	31	14	45	24	....	....	....	0.47	— 3.1	3	11,100	n.	48	nw.	29	19	10	1	2.8	
Lynchburg	681	83	88	29.39	30.15	+ .02	48.6	+ 2.8	79	20	60	27	30	37	39	42	38	75	2.27	— 0.7	5	3,028	nw.	24	nw.	28	19	5	6	3.8	T.
Mount Weather	1,725	10	57	28.26	30.13	+ .01	42.6	......	70	21	50	22	1	35	26	38	33	73	1.37	......	4	14,663	nw.	56	nw.	28	16	9	5	3.9	2.0
Norfolk	91	102	111	30.04	30.14	+ .03	51.7	+ 1.4	76	18	59	30	14	44	27	46	42	74	3.10	— 2.2	4	6,215	n.	27	sw.	21	21	5	4	2.8	
Richmond	144	145	153	30.00	30.16	+ .04	50.0	+ 1.5	79	20	60	29	13	40	33	....	....	....	0.87	— 1.6	5	5,885	n.	30	s.	21	16	9	5	3.5	1.9
Wytheville	2,293	40	47	27.75	30.18	+ .05	44.7	+ 1.6	78	19	56	22	14	33	44	38	34	78	2.34	+ 0.1	7	3,795	w.	24	s.	18	16	6	8	4.1	3.1
S. Atlantic States.							55.1	+ 1.0										74	0.95	— 1.9										3.2	
Asheville	2,255	53	75	27.79	30.20	+ .06	46.7	+ 0.3	74	3	58	17	14	35	45	41	38	82	2.54	— 0.1	6	5,428	nw.	30	se.	17	18	6	6	3.5	2.5
Charlotte	773	68	76	29.32	30.18	+ .05	52.4	+ 2.5	77	19	62	28	14	43	32	45	39	68	1.07	— 2.0	5	4,702	ne.	30	sw.	11	15	9	6	3.6	1.5
Hatteras	11	12	47	30.13	30.14	+ .03	54.9	— 0.7	74	19	61	38	13	48	24	51	48	81	1.38	— 3.8	3	10,476	n.	44	n.	29	24	2	4	2.2	
Raleigh	376	71	79	29.76	30.17	+ .04	52.2	+ 2.6	77	20	63	28	14	41	34	44	37	64	0.69	— 1.5	3	4,478	n.	24	nw.	28	18	8	4	3.1	
Wilmington	78	81	91	30.09	30.18	+ .06	54.8	+ 0.2	80	19	66	32	14	44	32	47	43	75	1.29	— 1.2	4	4,909	n.	23	s.	18	22	7	1	2.1	
Charleston	48	14	92	30.12	30.17	+ .05	58.6	+ 1.0	78	22	67	35	16	50	27	52	48	76	0.38	— 2.6	1	6,774	ne.	32	n.	1	16	12	2	3.1	
Columbia, S. C.	351	41	57	29.78	30.18	+ .06	54.6	— 0.2	79	21	66	26	14	43	34	46	40	68	0.80	— 1.5	3	4,392	ne.	26	sw.	18	15	9	6	4.2	T.
Augusta	180	89	97	29.98	30.17	+ .04	54.8	+ 1.4	80	18	67	29	14	42	38	47	42	74	0.95	— 2.1	3	3,770	nw.	30	w.	11	14	11	5	3.8	
Savannah	65	81	89	30.10	30.17	+ .05	58.9	+ 1.5	80	22	68	31	13	49	29	51	46	72	0.36	— 1.9	1	5,036	ne.	24	sw.	18	16	9	5	3.7	
Jacksonville	43	101	129	30.09	30.14	+ .04	62.9	+ 1.5	83	22	71	33	13	55	26	57	54	80	0.01	— 2.5	1	7,635	ne.	34	s.	14	22	6	2	2.8	
Florida Peninsula.							71.6	+ 0.5										80	6.30	+ 3.0										4.3	
Jupiter	28	10	48	30.03	30.06	+ .01	72.4	+ 0.6	82	19	78	42	14	67	24	67	64	80	4.53	+ 1.7	4	11,968	e.	37	ne.	1	7	18	5	5.2	
Key West	22	10	53	30.00	30.02	.00	74.4	+ 0.2	83	22	78	58	14	70	12	69	67	81	10.82	+ 8.6	10	9,258	ne.	28	ne.	7	17	6	7	4.0	
Sand Key	25	41	71	29.97	30.00	— .02	74.9	......	81	23	78	62	14	72	12	....	....	....	6.53	......	8	16,544	ne.	48	ne.	6	17	8	5	4.0	
Tampa	35	79	96	30.05	30.09	+ .01	68.0	+ 0.6	86	19	77	39	14	59	29	61	58	79	0.56	— 1.2	4	6,996	ne.	26	ne.	1	19	4	7	4.0	
East Gulf States.							58.7	+ 3.0										73	1.60	— 1.9										4.0	
Atlanta	1,174	190	216	28.91	30.17	+ .04	53.3	+ 1.5	74	9	62	26	13	45	27	45	38	63	1.08	— 2.5	5	9,251	e.	44	nw.	11	16	7	7	4.0	T.
Macon	370	55	66	29.78	30.18	+ .05	56.1	+ 2.0	81	21	68	30	13	44	36	....	....	....	1.10	— 1.8	3	3,172	nw.	22	sw.	11	17	10	3	3.3	
Thomasville	273	8	57	29.85	30.15	+ .03	60.4	+ 1.4	84	19	72	28	13	48	35	52	48	77	0.59	— 2.1	1	4,157	ne.	26	sw.	11	20	4	6	3.0	
Pensacola	56	79	96	30.06	30.12	+ .01	63.6	+ 4.4	79	10	71	35	13	56	23	....	....	....	0.63	— 3.1	4	8,049	ne.	43	sw.	14	16	11	3	3.4	
Anniston	741	9	58	29.38	30.18	+ .06	53.4	+ 2.2	78	21	66	22	13	41	37	....	....	....	3.81	+ 1.2	7	4,174	se.	24	nw.	11	14	8	8	4.4	T.
Birmingham	700	136	144	29.40	30.17	+ .05	55.6	+ 1.3	80	19	65	28	13	46	29	48	43	69	1.99	— 1.9	6	6,237	ne.	38	se.	17	11	9	10	4.9	
Mobile	57	98	106	30.06	30.12	+ .01	63.2	+ 5.3	81	10	72	36	13	54	26	56	51	73	1.34	— 2.5	5	6,334	n.	32	se.	16	15	13	2	3.7	
Montgomery	223	100	112	29.91	30.16	+ .04	57.9	+ 2.7	84	19	68	31	13	47	31	50	45	71	1.44	— 1.9	4	4,948	e.	26	w.	11	16	9	5	3.5	
Meridian	375	84	93	29.73	30.14	+ .02	57.4	+ 4.0	85	19	69	27	13	46	32	51	48	79	1.74	— 1.4	6	4,243	ne.	27	s.	17	12	9	9	4.9	
Vicksburg	247	62	74	29.85	30.13	+ .01	59.3	+ 3.9	83	19	69	33	13	49	31	52	48	72	2.80	— 2.0	7	5,031	ne.	30	s.	17	14	8	8	4.6	
New Orleans	51	88	121	30.04	30.10	.00	65.5	+ 4.8	83	19	73	40	13	58	22	59	56	79	1.03	— 3.1	2	7,328	ne.	35	s.	17	15	6	9	4.2	
West Gulf States.							57.6	+ 1.3										73	2.46	— 1.3										5.1	
Shreveport	249	77	84	29.84	30.12	+ .01	56.8	+ 2.2	82	9	67	30	13	46	31	49	44	70	2.51	— 2.3	8	4,837	ne.	32	s.	16	17	7	6	4.0	
Bentonville	1,303	11	44	28.69	30.12	+ .01	46.0	......	75	5	56	19	22	36	34	....	....	....	2.77	......	10	4,076	se.	35	s.	16	12	8	10	5.5	2.2
Fort Smith	457	79	94	29.63	30.12	+ .01	50.2	+ 0.9	80	10	60	25	22	40	34	42	36	64	2.09	— 1.6	10	5,947	e.	50	w.	16	6	15	9	5.4	0.5
Little Rock	357	93	100	29.76	30.15	+ .03	51.5	+ 0.7	81	10	61	30	22	42	31	44	38	66	4.33	— 0.9	8	5,026	nw.	39	w.	16	8	10	12	5.9	
Corpus Christi	20	48	53	30.02	30.04	+ .03	64.8	+ 1.8	91	17	72	33	21	58	36	61	59	86	5.10	+ 2.1	10	6,932	n.	28	ne.	22	9	9	12	5.6	
Fort Worth	670	106	114	29.38	30.10	.00	55.2	+ 0.4	85	9	65	22	21	45	37	....	....	....	2.19	— 0.5	11	6,774	e.	38	sw.	16	12	13	5	4.6	1.0
Galveston	54	106	112	30.02	30.08	— .01	64.0	+ 1.6	78	11	70	36	20	59	23	62	60	89	0.45	— 4.0	6	8,537	ne.	33	n.	12	9	17	4	4.7	
Palestine	510	73	79	29.54	30.08	— .03	57.4	+ 1.2	83	17	67	29	21	47	31	50	45	71	1.66	— 2.8	11	3,190	ne.	30	sw.	16	11	8	11	5.4	
San Antonio	701	80	91	29.31	30.04	— .04	60.7	+ 1.7	87	17	71	26	21	51	37	53	47	67	1.83	— 0.7	6	5,687	ne.	27	ne.	18	12	5	13	5.2	
Taylor	583	55	63	29.46	30.07	— .01	58.4	......	87	17	69	25	21	48	37	....	....	....	1.01	......	6	5,957	n.	30	s.	13	11	10	9	5.1	
Ohio Val. and Tenn.							46.0	+ 1.4										73	4.31	+ 0.6										5.7	
Chattanooga	762	106	112	29.37	30.20	+ .06	51.0	+ 1.1	75	10	61	27	14	41	35	44	39	72	2.96	— 0.8	7	4,824	ne.	36	w.	21	16	5	9	4.7	6.5
Knoxville	1,004	35	88	29.10	30.18	+ .05	48.6	+ 2.0	80	20	60	24	14	38	36	42	37	73	3.78	0	8	4,778	sw.	40	sw.	21	12	7	11	5.2	2.5
Memphis	399	76	97	29.73	30.17	+ .05	51.2	+ 2.3	78	10	60	28	13	42	29	44	39	69	14.53	+ 9.9	8	5,502	ne.	36	w.	17	12	11	7	4.4	T.
Nashville	546	79	91	29.59	30.19	+ .07	48.7	+ 0.7	76	20	59	26	13	38	33	43	39	74	5.88	+ 2.0	8	4,062	w.	34	se.	17	9	8	13	5.6	3.0
Lexington	989	75	102	29.11	30.20	+ .08	45.2	+ 0.7	77	20	54	25	14	36	33	....	....	....	3.95	+ 0.2	8	7,635	se.	48	s.	17	9	8	13	6.2	5.0
Louisville	525	111	132	29.60	30.19	+ .07	46.8	+ 1.5	78	20	56	28	14	38	35	41	37	76	7.10	+ 3.0	6	5,618	n.	44	sw.	21	10	9	11	5.7	3.0
Evansville	431	72	82	29.68	30.16	+ .04	46.3	......	69	6	55	28	14	38	32	....	....	....	4.73	......	8	4,694	ne.	44	sw.	21	5	15	10	5.8	0.9
Indianapolis	822	154	164	29.26	30.17	+ .07	42.9	+ 2.0	67	7	51	25	14	35	31	37	33	72	3.06	— 0.8	8	6,606	se.	58	sw.	21	10	6	14	6.0	T.
Cincinnati	628	152	160	29.49	30.19	+ .07	45.0	+ 1.1	75	20	54	26	14	36	35	39	34	68	3.04	— 0.3	10	4,573	ne.	31	sw.	21	6	7	17	6.3	0.7
Columbus	824	173	190	29.27	30.17	+ .06	42.4	+ 1.2	72	21	50	26	29	34	32	37	32	72	2.57	— 0.7	7	7,983	nw.	56	sw.	21	9	9	12	5.8	0.3
Pittsburg	842	336	352	29.23	30.16	+ .06	43.2	+ 0.4	75	21	51	27	1	36	26	38	34	75	0.95	— 1.5	11	6,787	w.	43	w.	22	9	4	17	6.9	2.5
Parkersburg	638	77	84	29.51	30.18	+ .06	44.4	+ 0.4	78	20	54	25	25	35	32	38	34	75	1.78	— 1.3	8	3,904	w.	32	w.	21	6	12	12	6.5	T.
Elkins	1,940	41	50	28.08	30.20	+ .08	42.4	+ 3.0	78	21	54	20	25	31	43	35	32	81	2.10	— 1.8	10	2,804	w.	26	w.	18	12	7	11	5.1	3.0
Lower Lake Region.							39.6	+ 0.6										78	2.19	— 1.0										7.1	
Buffalo	767	178	206	29.26	30.12	+ .07	39.4	+ 1.2	66	21	45	22	29	34	30	36	33	82	1.90	— 1.6	11	11,486	w.	70	sw.	22	4	8	18	7.5	0.9
Canton	448	10	71	29.59	30.08	......	31.9	......	60	18	39	10	15	25	30	....	....	....	2.41	......	15	7,909	w.	53	sw.	22	9	4	17	6.4	8.9
Oswego	335	76	91	29.72	30.09	+ .04	38.1	— 0.4	64	18	43	22	29	33	23	36	32	80	2.09	— 1.3	14	8,694	n.	36	nw.	22	5	3	22	7.5	2.1
Rochester	523	81	102	29.54	30.12	+ .07	38.2	+ 0.8	68	18	44	19	14	32	25	34	31	80	2.22	— 0.6	11	6,713	w.	40	w.	22	4	6	20	7.7	5.7
Syracuse	597	97	113	29.45	30.11	+ .05	37.2	......	63	18	43	19	29	31	28	....	....	....	2.21	......	17	7,974	w.	44	s.	18	4	9	17	7.2	13.4
Erie	713	92	102	29.34	30.12	+ .06	40.7	— 0.3	71	21	46	29	30	36	30	36	32	72	1.80	— 2.3	13	7,932	w.	35	se.	18	6	5	19	7.3	0.9
Cleveland	762	190	201	29.31	30.15	+ .08	40.8	+ 1.1	70	21	46	28	14	35	30	37	32	74	2.10	— 0.8	12	10,720	sw.	52	sw.	21	5	10	15	6.8	3.4
Sandusky	629	62	70	29.45	30.15	+ .07	40.4	0.0	71	21	46	25	14	35	33	....	....	....	2.21	— 0.8	12	5,818	w.	32	sw.	21	7	6	17	6.6	0.1
Toledo	628	207	246	29.46	30.16	+ .09	40.0	+ 0.8	67	21	46	26	29	34	31	36	33	79	2.90	0	9	9,575	sw.	68	sw.	21	6	5	19	6.9	0.4
Detroit	730	153	193	29.34	30.15	+ .09	39.6	+ 1.5	59	21	45	21	14	34	24	36	33	81	2.28	— 0.4	9	7,798	w.	50	sw.	21	7	5	18	7.0	1.2
Upper Lake Region.							36.5	+ 2.6										81	3.20	+ 0.6										7.6	
Alpena	609	13	92	29.44	30.12	+ .11	36.2	+ 3.4	52	2	42	19	14	30	27	33	30	82	4.25	+ 1.4	13	7,826	w.	46	se.	17	7	5	18	6.9	2.8
Escanaba	612	40	82	29.44	30.12	+ .09	35.0	+ 3.8	50	9	40	14	24	30	26	32	29	80	4.85	+ 2.6	10	7,401	sw.	44	ne.	21	4	11	15	7.4	8.8
Grand Haven	632	54	92	29.43	30.13	+ .09	39.0	+ 1.9	61	8	45	24	1	33	26	35	32	80	2.78	— 0.2	12	9,023	se.	64	sw.	21	2	9	19	8.1	0.2

Table I.—*Climatological data for U. S. Weather Bureau stations, November, 1906*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches: Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. + mean min. ÷ 2	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
Up. Lake Reg—Cont.																															
Grand Rapids	707	121	162	29.35	30.14	+ .09	39.2	+ 1.6	61	5	45	24	1	33	23	35	33	82	3.21	− 0.3	11	8,182	e.	66	sw.	21	2	9	19	8.1	T.
Houghton	668	66	74	29.35	30.09	+ .07	34.6	......	55	5	39	19	14	30	25	.....	.....	.....	4.75	......	16	5,643	w.	29	w.	30	3	4	23	8.2	21.9
Marquette	734	77	116	29.29	30.11	+ .09	34.7	+ 3.3	52	5	40	18	23	30	25	32	28	78	4.06	+ 1.3	16	7,851	w.	42	e.	26	3	7	20	7.9	19.4
Port Huron	638	70	120	29.42	30.14	+ .09	38.1	+ 1.7	55	18	44	19	14	32	20	34	31	80	1.95	− 0.9	9	8,219	w.	48	sw.	21	7	4	19	6.9	0.2
Sault Ste. Marie	614	40	61	29.42	30.13	+ .12	33.8	+ 3.5	49	2	38	20	29	30	21	31	29	83	2.84	+ 0.3	11	7,185	e.	43	w.	30	4	4	22	8.3	6.7
Chicago	823	140	310	29.24	30.15	+ .08	41.8	+ 3.4	64	5	47	25	24	36	26	38	34	76	3.08	+ 0.3	13	10,471	w.	59	sw.	21	4	11	15	6.7	2.8
Milwaukee	681	122	142	29.39	30.15	+ .10	39.2	+ 4.0	60	8	44	23	24	34	19	36	33	84	2.79	+ 0.7	8	8,184	w.	55	se.	16	6	10	14	6.4	T.
Green Bay	617	49	86	29.42	30.10	+ .06	35.4	+ 3.3	53	8	41	18	24	30	•19	33	29	80	3.76	+ 1.7	9	7,851	sw.	50	n.	21	3	5	22	8.1	0.6
Duluth	1,133	11	47	28.83	30.09	+ .05	29.6	+ 0.9	51	7	35	6	30	25	29	28	26	88	1.68	+ 0.1	10	10,584	w.	48	ne.	26	2	9	19	7.8	9.9
North Dakota.							26.3	+ 0.8										84	1.80	+ 1.0										6.5	
Moorhead	940	8	57	29.04	30.09	+ .02	26.6	+ 2.4	57	5	34	−10	20	19	30	25	24	90	3.02	+ 2.1	12	6,756	nw.	29	se.	1	7	6	17	6.6	14.6
Bismarck	1,674	8	57	28.26	30.11	+ .04	27.0	+ 1.1	63	4	37	− 3	28	17	35	23	20	79	1.38	+ 0.7	8	8,438	nw.	46	nw.	17	11	6	13	5.9	6.9
Devils Lake	1,482	11	44	28.42	30.06	.00	23.2	......	57	5	32	−14	20	15	31	22	18	82	2.59	......	9	10,285	w.	48	w.	29	7	6	17	6.4	19.9
Williston	1,875	14	44	28.01	30.06	.00	25.2	− 0.9	59	7	35	− 8	25	16	37	22	19	83	1.00	+ 0.4	5	7,528	w.	40	n.	16	2	15	13	7.1	3.7
Upper Miss. Valley.							38.1	+ 1.3										78	3.11	+ 1.0										6.9	
Minneapolis	......	102	208	......	......	......	33.6	+ 3.9	65	6	39	10	20	28	29	.....	.....	...	2.58	+ 1.9	9	8,735	w.	35	se.	16	5	3	22	7.8	3.0
St. Paul	837	171	179	29.17	30.11	+ .05	33.6	+ 3.7	66	6	40	10	20	28	28	31	27	79	1.73	+ 0.6	7	7,862	se.	34	nw.	8	4	6	20	7.8	1.6
La Crosse	714	71	87	29.34	30.13	+ .06	36.0	+ 2.6	66	6	41	12	24	31	26	.....	.....	.....	2.05	+ 0.6	10	5,661	s.	24	nw.	9	4	6	20	7.8	6.9
Madison	974	70	78	29.05	30.14	+ .08	36.0	+ 1.6	64	5	42	15	24	30	24	32	30	82	2.36	+ 0.6	8	7,288	s.	33	n.	21	7	7	16	6.8	2.2
Charles City	1,015	8	58	29.03	30.15	+ .07	32.9	− 0.1	69	6	40	0	22	26	36	30	28	87	3.21	+ 1.7	9	5,748	se.	24	se.	16	3	8	19	7.8	6.3
Davenport	606	71	79	29.48	30.16	+ .08	38.2	+ 1.4	71	6	45	17	24	32	26	34	31	79	2.66	+ 0.6	9	4,797	nw.	26	s.	16	6	9	15	7.0	3.1
Des Moines	861	84	101	29.23	30.16	+ .08	37.1	+ 0.7	73	6	44	8	22	30	28	33	29	77	2.29	+ 0.6	9	5,402	nw.	28	w.	26	4	7	19	7.5	6.2
Dubuque	698	100	117	29.39	30.17	+ .10	36.6	+ 1.6	66	6	43	11	24	30	28	33	30	82	2.95	+ 0.8	14	4,843	nw.	25	se.	16	7	6	17	7.3	4.6
Keokuk	614	64	77	29.46	30.16	+ .07	38.8	0.0	73	6	45	18	22	32	28	34	30	76	1.92	− 0.2	7	4,848	se.	31	sw.	26	*10	*5	*14	6.1	4.5
Cairo	356	87	93	29.78	30.18	+ .06	46.5	+ 0.3	75	7	55	26	13	38	30	41	37	76	7.88	+ 3.7	10	5,791	ne.	41	w.	17	7	11	12	6.1	4.3
La Salle	536	56	64	29.59	30.18	+ .10	39.2	......	71	6	47	20	24	32	33	.....	.....	.....	1.98	......	10	5,293	w.	34	sw.	26	7	9	14	6.7	1.1
Peoria	609	11	45	29.49	30.17	+ .08	39.5	......	72	6	47	19	24	32	36	35	31	77	2.42	......	11	5,992	s.	38	sw.	26	8	8	14	6.0	0.3
Springfield, Ill.	644	10	92	29.46	30.16	+ .06	41.4	+ 0.5	71	5	49	25	22	34	29	36	31	73	3.13	+ 0.2	8	5,992	se.	29	se.	16	7	7	16	6.4	0.1
Hannibal	534	75	109	29.58	30.17	+ .08	41.0	+ 0.8	74	5	49	19	22	33	29	.....	.....	.....	2.97	+ 0.9	9	5,746	sw.	36	sw.	26	9	4	17	6.5	3.3
St. Louis	567	208	217	29.54	30.16	+ .06	43.8	+ 0.2	72	5	51	26	13	37	25	38	33	70	4.67	+ 1.6	8	6,734	se.	36	w.	21	9	6	15	6.1	2.0
Missouri Valley.							37.3	+ 0.5										73	[illegible]	+ 0.2										6.4	
Columbia, Mo.	784	11	84	29.30	30.15	+ .06	40.2	− 1.8	75	5	49	15	13	32	33	.....	.....	.....	2.93	+ 0.6	9	5,455	se.	24	sw.	26	9	10	11	5.8	5.5
Kansas City	963	78	95	29.13	30.20	+ .11	41.8	+ 1.1	75	6	49	20	19	35	31	36	31	73	3.08	+ 0.9	9	4,535	nw.	29	se.	16	7	11	12	6.0	6.0
Springfield, Mo	1,324	98	104	28.71	30.14	+ .04	43.8	+ .08	72	5	52	21	22	36	30	38	32	71	2.66	− 0.4	9	7,406	se.	44	s.	16	11	9	10	5.2	5.5
Iola	984	40	47	29.10	30.18	+ .09	42.8	......	74	6	52	17	22	34	39	.....	.....	.....	4.06	......	11	5,229	sw.	35	sw.	16	6	6	18	7.0	4.7
Topeka	......	85	89	......	......	......	41.1	− 0.1	74	6	50	16	22	32	36	.....	.....	.....	2.83	+ 1.8	9	5,614	s.	28	nw.	16	7	10	13	6.1	7.8
Lincoln	1,189	11	84	28.83	30.14	+ .06	38.4	+ 0.3	71	5	46	18	19	31	32	34	28	69	0.28	− 0.4	6	7,093	n.	30	nw.	26	8	5	17	6.7	1.3
Omaha	1,105	115	121	28.94	30.15	+ .07	38.0	+ 1.2	69	6	45	16	19	31	25	33	27	67	0.52	− 0.5	6	6,065	s.	30	nw.	10	4	8	18	7.6	1.8
Valentine	2,598	47	54	27.33	30.13	+ .05	33.2	− 1.1	67	5	44	3	19	22	34	28	25	78	0.92	+ 0.5	8	7,956	nw.	48	nw.	16	11	10	9	5.0	6.0
Sioux City	1,135	96	164	28.88	30.14	+ .06	34.5	+ 0.2	66	6	41	13	19	28	27	.....	.....	.....	0.65	− 0.2	6	8,980	nw.	48	s.	1	4	10	16	7.2	2.1
Pierre	1,572	43	50	28.40	30.12	+ .04	33.8	+ 1.9	75	5	43	6	20	25	38	29	24	75	0.45	0.0	8	5,805	nw.	37	nw.	16	7	8	15	6.1	3.1
Huron	1,306	56	67	28.68	30.12	+ .04	31.1	+ 1.6	59	7	40	1	20	22	33	28	24	80	0.70	+ 0.1	9	8,909	nw.	44	s.	1	7	10	13	6.2	2.4
Yankton	1,283	49	57	28.76	30.12	+ .04	34.2	+ 1.4	64	7	42	10	21	26	30	.....	.....	.....	0.66	0.0	5	5,931	w.	32	s.	1	6	2	22	7.7	0.4
Northern Slope.							31.6	− 1.2										76	0.89	+ 0.4										5.8	
Havre	2,505	11	44	27.35	30.07	+ .04	27.0	− 2.9	60	4	37	− 9	19	17	39	25	22	84	0.74	+ 0.1	7	6,221	nw.	36	nw.	16	11	7	12	5.4	2.1
Miles City	2,371	26	48	27.51	30.14	+ .07	32.2	− 0.9	67	4	41	5	23	23	41	27	22	73	0.84	+ 0.5	12	4,660	sw.	39	nw.	16	9	9	12	5.4	2.0
Helena	4,110	8	56	25.83	30.14	+ .04	29.0	− 1.5	62	7	38	0	28	20	30	25	21	76	1.38	+ 0.7	14	4,439	sw.	50	sw.	10	10	4	16	6.5	7.5
Kalispell	2,962	8	34	26.98	30.11	+ .04	31.8	......	54	10	38	10	27	25	24	29	26	80	1.79	......	15	2,822	w.	26	sw.	15	4	8	18	7.6	3.2
Rapid City	3,234	46	50	26.60	30.12	+ .04	34.2	− 0.7	64	5	44	4	19	24	34	29	25	76	0.40	0.0	6	4,234	nw.	50	w.	29	12	9	9	4.7	T.
Cheyenne	6,088	56	64	23.98	30.10	+ .03	32.0	− 2.2	62	15	42	1	19	22	32	27	22	72	1.42	+ 1.1	8	7,539	nw.	60	nw.	15	11	8	11	5.3	10.4
Lander	5,372	26	36	24.64	30.13	+ .03	30.7	− 0.9	63	10	43	1	27	19	33	26	22	75	0.41	− 0.2	4	2,600	sw.	46	sw.	15	5	18	7	5.7	4.1
Yellowstone Park	6,200	11	48	23.86	30.14	+ .03	27.4	......	53	9	36	− 6	19	19	33	22	18	71	0.63	......	14	6,105	s.	37	sw.	15	9	5	16	6.0	3.2
North Platte	2,821	11	51	27.14	30.15	+ .07	35.9	+ 0.7	68	8	47	10	21	25	36	30	27	80	1.01	+ 0.7	3	5,592	nw.	44	n.	16	10	7	13	5.9	2.8
Middle Slope.							40.8	− 0.5										72	1.31	+ 0.4										5.6	
Denver	5,291	129	136	24.73	30.10	+ .04	37.2	− 0.9	74	15	48	1	20	26	38	31	26	69	1.30	+ 0.7	7	5,039	s.	46	w.	15	12	8	10	5.1	13.0
Pueblo	4,685	80	86	25.30	30.08	+ .03	37.8	− 1.0	75	8	51	− 9	20	25	47	31	24	66	0.20	− 0.1	2	4,266	nw.	37	w.	13	16	8	6	3.8	2.7
Concordia	1,398	42	47	28.65	30.16	+ .08	40.2	+ 0.2	73	6	48	11	22	32	34	35	31	75	0.71	+ 0.1	4	4,430	s.	24	nw.	16	7	9	14	6.4	4.2
Dodge	2,509	44	54	27.49	30.15	+ .08	40.2	0.0	73	8	50	2	21	30	38	35	32	80	1.50	+ 1.0	8	6,939	se.	35	s.	5	8	11	11	5.7	7.0
Wichita	1,358	78	86	28.70	30.17	+ .09	42.5	− 0.3	75	6	50	15	22	35	35	37	32	70	2.92	+ 2.0	9	5,729	se.	25	s.	16	5	10	15	6.5	8.7
Oklahoma	1,214	10	47	28.82	30.13	+ .05	46.9	− 1.0	81	10	56	18	21	38	39	40	36	74	1.25	− 1.2	11	9,582	n.	48	s.	16	10	5	15	6.1	2.1
Southern Slope.							45.4	− 2.9										78	3.02	+ 1.9										5.7	
Abilene	1,738	45	54	28.26	30.10	+ .03	52.1	+ 0.1	82	10	62	20	21	42	35	46	42	77	2.41	+ 1.0	12	5,324	se.	31	s.	25	9	4	17	6.5	0.1
Amarillo	3,676	10	49	26.30	30.10	+ .05	41.7	− 2.8	75	8	52	4	20	31	39	35	31	78	2.58	+ 1.8	9	5,345	se.	32	nw.	19	11	11	8	4.7	14.8
Del Rio	944	8	57	29.06	30.06	+ .01	59.4	......	91	17	71	17	21	48	46	.....	.....	.....	0.79	......	8	5,349	se.	35	n.	17	10	10	10	5.6	T.
Roswell	3,578	9	57	26.36	30.05	+ .02	42.4	− 6.0	82	15	55	− 6	21	30	49	37	33	78	4.06	+ 2.9	10	3,952	n.	42	nw.	13	9	10	11	5.9	17.5
Southern Plateau.							48.0	− 0.8										56	1.22	+ 0.6										3.6	
El Paso	3,762	10	110	26.20	29.99	− .01	51.9	+ 0.4	81	15	63	12	20	41	36	43	35	62	25.0	+ 2.0	7	8,309	ne.	50	w.	17	13	6	11	4.6	8.4
Santa Fe	7,013	33	39	23.23	30.04	+ .01	38.0	+ 0.4	64	9	48	4	20	28	29	31	25	64	0.68	− 0.1	8	5,807	ne.	37	se.	23	13	12	5	4.5	2.6
Flagstaff	6,907	12	44	23.29	29.96	− .06	33.8	− 2.0	60	14	49	− 8	25	19	41	27	20	67	2.71	+ 1.3	6	4,864	sw.	37	sw.	15	16	7	7	3.6	27.9
Phoenix	1,108	50	56	28.77	29.93	− .05	58.6	+ 0.1	91	12	73	32	30	44	42	46	34	45	1.20	+ 0.7	3	2,637	e.	20	nw.	18	19	9	2	2.8	
Yuma	141	16	46	29.80	29.95	− .03	60.8	− 1.5	93	14	75	29	30	46	41	48	36	47	0.23	− 0.1	2	3,789	n.	33	n.	19	25	3	2	1.8	
Independence	3,910	11	42	26.02	30.05	.00	45.2	− 2.2	81	13	57	16	24	33	37	35	24	51	0.02	− 0.2	1	6,377	n.	46	n.	18	11	11	8	5.0	1.0
Middle Plateau.							37.4	− 1.8										66	1.47	+ 0.7										5.7	
Reno	4,532	56	63	25.51	30.12	+ .01	38.8	− 2.3	74	14	50	13	29	27	41	33	27	69	0.76	+ 0.1	6	3,796	w.	40	w.	15	11	14	5	4.1	1.6
Tonopah	6,080	12	20	24.07	30.16	......	35.6	......	70	14	43	6	19	28	27	28	19	56	0.69	......	3	6,895	w.	41	nw.	17	7	15	8	5.2	9.5
Winnemucca	4,344	18	56	25.67	30.15	+ .01	35.2	− 1.9	70	10	48	− 4	30	22	49	28	22	67	0.67	+ 0.1	6	5,421	ne.	44	sw.	15	11	6	13	5.7	8.6
Modena	5,479	10	43	24.60	30.05	− .03	33.6	− 5.8	72	14	46	− 2	29	21	42	27	20	65	1.42	+ 1.2	7	6,685	w.	41	sw.	4	11	9	10	5.3	13.1
Salt Lake City	4,366	105	110	25.65	30.08	− .04	39.2	− 0.6	67	14	47	11	20	31	31	34	28	66	2.10	+ 0.7	11	4,119	se.	66	nw.	15	10	6	14	6.0	18.4
Durango	6,546	18	56	23.63	30.03	− .01	37.5	− 0.2	66	13	50	5	20	26	37	30	25	71	2.66	+ 1.5	9	3,684	nw.	24	w.	16	12	10	8	4.7	12.7
Grand Junction	4,608	43	51	25.39	30.01	− .07	40.0	− 0.1	68	5	50	13	20	30	33	33	27	67	1.23	+ 0.6	9	2,783	nw.	27	nw.	15	9	13	8	5.6	4.4
Northern Plateau.							36.0	− 0.9										74	1.91	+ 0.5										7.1	
Baker City	3,471	48	58	26.80	30.15	− .01	33.9	− 2.9	62	14	42	0	28	26	30	31	26	72	1.09	+ 0.2	14	4,889	s.	32	sw.	15	6	12	12	6.0	6.2
Boise	2,739	78	86	27.26	30.18	+ .01	38.8	+ 0.3	65	8	46	15	28	31	31	34	28	69	0.81	− 0.5	14	4,318	se.	43	w.	15	6	6	18	7.1	2.2
Lewiston	757	10	51	29.30	30.12	.00	41.3	− 1.3	65	10	48	22	26	35	27	.....	.....	.....	3.22	+ 1.5	14	3,568	e.	48	w.	15	3	5	22	8.2	0.8
Pocatello	4,477	46	54	25.53	30.15	+ .01	35.0	+ 2.0	66	9	44	5	19	26	36	30	24	65	0.76	− 0.5	9	7,085	se.	39	sw.	15	10	11	9	5.1	1.9
Spokane	1,929	101	110	28.04	30.14	+ .04	35.4	− 2.4	58	14	41	14	28	30	20	33	30	82	2.90	+ 1.2	17	3,977	n.	34	sw.	15	3	5	22	8.1	2.9
Walla Walla	1,000	71	79	29.05	30.14	+ .01	41.8	− 1.2	69	15	48	22	26	35	30	39	37	83	2.70	+ 1.3	16	4,570	s.	40	sw.	15	2	5	23	8.0	T.
N. Pac. Coast Reg.							45.5	+ 0.1										84	8.54	+ 1.6										7.6	
North Head	211	11	56	29.82	30.06	+ .01	47.2	− 1.0	59	10	51	36	23	43	13	45	43	84	10.23	+ 1.7	23	14,114	se.	87	se.	6	8	4	18	6.7	
Port Crescent	259	12	29	29.76	30.04	+ .04	42.3	0.0	59	12	48	28	29	37	17	.....	.....	.....	10.51	+ 4.1	16	3,892	se.	36	sw.	12	3	7	20	7.5	
Seattle	123	185	224	29.96	30.09	+ .05	45.2	− 0.1	61	9	50	30	24	41	14	43	40	84	7.67	+ 2.0	19	6,392	se.	43	s.	14	2	7	21	8.2	
Tacoma	213	113	120	29.84	30.07	+ .03	44.2	0.0	64	9	49	28	28	39	18	.....	.....	.....	7.74	+ 1.6	18	4,404	sw.	33	sw.	4	3	3	24	8.3	T.
Tatoosh Island	86	7	57	29.91	30.00	+ .03	46.4	0.0	57	11	50	37	27	43	10	44	41	83	10.74	− 1.4	23	12,311	e.	69	s.	12	6	4	20	7.5	
Portland, Oreg.	153	68	106	29.94	30.10	.00	46.2	+ 0.6	65	14	51	30	24	42	19	44	41	82	8.30	+ 2.5	22	5,102	se.	32	s.	6	5	6	19	7.6	
Roseburg	510	9	57	29.58	30.14	+ .02	46.7	+ 1.5	72	12	54	26	24	40	23	45	42	85	4.57	+ 0.9	19	2,295	s.	30	sw.	15	1	10	19	7.6	

TABLE I.—*Climatological data for U. S. Weather Bureau stations, November, 1906*—Continued.

Stations.	Elevation of instruments. Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit. Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches. Total.	Departure from normal.	Days with .01, or more.	Wind. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
Mid. Pac. Coast Reg.							53.1	− 0.4										67	1.54	− 1.7										4.0	
Eureka	62	62	80	30.08	30.15	+ .04	50.6	+ 0.5	67	11	56	33	23	45	21	48	45	80	3.13	− 2.3	14	5,520	n.	36	n.	29	9	9	12	5.4	
Mount Tamalpais	2,375	11	18	27.60	30.09	.00	49.0	......	71	14	54	32	28	44	16	42	34	60	1.90	......	7	16,982	nw.	70	ne.	30	11	11	8	4.5	1.0
Point Reyes Light	490	7	18	29.52	30.04	......	52.8	− 1.0	71	8	58	40	29	48	21	......	......	......	0.81	− 2.2	6	16,438	n.	76	nw.	17	17	8	5	3.7	
Red Bluff	332	50	56	29.74	30.10	− .01	53.6	− 0.3	81	11	63	31	24	44	31	46	39	63	1.19	− 1.9	5	5,415	nw.	36	n.	30	12	4	14	4.9	
Sacramento	69	106	117	30.00	30.08	− .01	53.2	− 0.3	76	14	63	32	24	43	28	46	38	62	0.99	− 1.2	5	6,196	n.	36	n.	30	21	1	8	3.3	
San Francisco	155	200	204	29.92	30.09	.00	55.4	− 0.9	77	11	62	40	29	49	23	49	42	68	1.59	− 1.1	6	6,289	nw.	64	ne.	30	17	8	5	3.5	
San Jose	141	78	88	29.92	30.07	......	52.4	......	79	14	64	28	27	40	34	......	......	......	0.98	......	6	......	nw.	......	......	...	18	7	5	3.3	
Southeast Farallon	30	9	17	30.05	30.08	......	52.5	......	59	14	55	44	22	50	12	......	......	......	0.72	......	6	13,379	nw.	53	nw.	17	18	5	7	3.8	
S. Pac. Coast Reg.							56.3	− 1.3										61	0.82	− 0.5										2.9	
Fresno	330	67	70	29.71	30.08	+ .02	51.4	− 4.0	76	11	62	29	30	40	32	45	39	66	0.73	− 0.4	4	3,157	nw.	24	nw.	17	21	5	4	2.9	
Los Angeles	338	116	123	29.63	30.00	− .02	58.8	− 0.4	91	12	70	36	28	48	39	48	39	57	0.85	− 0.5	6	3,629	ne.	25	nw.	17	13	11	6	4.1	
San Diego	87	94	102	29.88	29.97	− .05	58.2	− 0.4	86	14	66	39	25	50	26	50	43	63	0.62	− 0.2	4	4,522	nw.	28	nw.	18	26	2	2	1.5	
San Luis Obispo	201	47	54	29.83	30.05	− .01	56.7	− 0.3	88	8	68	27	27	45	48	47	38	59	1.08	− 0.9	5	4,415	n.	24	sw.	17	17	8	5	3.3	
West Indies.																															
Grand Turk	11	6	20	......	......	......	......	......	......	...	......	......	...	......	......	......	......	......	......	......	......	......	......	......	......	...	...	...	...	...	...
San Juan	82	48	90	29.82	29.90	.00	79.2	+ 0.6	90	8	85	70	25	74	14	73	71	78	4.17	− 2.3	15	9,211	e.	33	e.	22	8	16	6	5.1	
Panama.																															
Ancon	74	...	...	......	......	......	......	......	......	...	......	......	...	......	......	......	......	......	......	......	......	......	......	......	......	...	...	...	...	...	...
Naos	40	...	...	......	......	......	......	......	......	...	......	......	...	......	......	......	......	......	......	......	......	......	......	......	......	...	...	...	...	...	...

* Record for 29 days only.

TABLE II.—*Climatological record of cooperative observers, November, 1906.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alaga	......	......	......	0.48	
Ashville	78	25	51.8	3.21	T.
Auburn	75	29	56.4	2.99	
Benton	......	......	......	4.52	
Bermuda	85[d]	23[d]	60.8[d]	3.38	
Boligee	86	25	57.1	2.43	
Bridgeport	......	......	......	3.59	5.0
Burkeville	......	......	......	1.20	
Calera	......	......	......	0.55	
Camphill	......	......	......	1.23	
Cedar Bluff	......	......	......	4.83	0.5
Citronelle	84	29	62.8	1.84	
Clanton	81	25	55.8	1.92	
Cordova	87	20	53.4	2.53	
Dadeville	......	......	......	0.68	
Daphne	86	31	64.0	2.31	
Decatur	83	23	51.5	2.63	1.2
Demopolis	......	......	......	1.10	
Eufaula	76	30	55.2	1.51	
Evergreen	86	25	61.9	1.13	
Flomaton	......	......	......	0.30	
Florence	83	21	53.1	3.61	0.3
Fort Deposit	87	35	59.4	1.70	
Gadsden	80	24	54.2	3.76	
Goodwater	84	23	56.2	3.32	
Greensboro	83	28	58.1	1.96	
Greenville	......	......	......	1.15	
Guntersville	......	......	......	3.54	0.5
Hamilton	84	20	53.8	3.52	
Highland Home	82	31	59.4	3.10	
Lotohatchie	......	......	......	0.55	
Livingston	84	23	56.4	1.23	
Lock No. 4	79	23	53.2	3.68	T.
Lucy	81	22	59.2	1.11	
Madison Station	......	......	......	3.04	2.0
Maplegrove	81	22	51.2	3.74	
Milstead	......	......	......	2.60	
Newbern	86	24	58.0	1.26	
Oneonta	82	22	52.6	2.21	T.
Opelika	81	25	56.6	2.20	T.
Ozark	80	26	58.3	2.89	
Prattville	......	......	......	1.59	
Pushmataha	86	25	58.6	2.41	
Riverton	82	19	50.8	4.58	T.
Scottsboro	81	22	51.8	5.80	3.0
Selma	86	24	58.3	......	
Spring Hill	......	......	......	1.10	
Talladega	81	23	54.1	2.81	
Tallassee	......	......	......	1.78	
Thomasville	87	25	56.7	1.86	
Tuscaloosa	84	25	54.7	1.83	
Tuscumbia	78	24	51.2	3.71	
Tuskegee	82	28	59.1	2.63	
Union Springs	80	26	57.0	4.25	
Uniontown	83	24	58.0	1.13	
Valleyhead	78	20	50.4	3.50	
***Alabama*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Vienna	......	......	......	1.90	
Wetumpka	83	25	58.4	1.55	
Alaska.					
Loring	47	25	36.8	21.57	T.
Killisnoo	51	25	36.7	9.55	4.0
Skagway	46	20	32.3	6.47	......
Arizona.					
Allaire Ranch	......	......	......	0.95	0.5
Arizona Canal Co. Dam	95	26	58.8	1.21	
Aztec	90	28	59.7	0.70	
Benson	87	16	53.6	0.97	1.0
Bisbee	79	16	51.6	1.23	4.2
Blue	75	8	43.2	1.91	3.0
Bonita	......	......	......	0.70	
Bowie	85	18	53.6	1.35	2.0
Buckeye	88	26	55.4	0.97	
Casagrande	......	......	......	0.75	
Clarsons Mill	59	10	34.5	2.83	22.3
Clifton	......	......	......	1.72	3.5
Cline	85	25	54.0	1.92	
Cochise *[1]	80	20	52.0	......	......
Columbia	87	30	55.5	2.12	
Congress	84	32	55.3	2.40	
Douglas	86	18	54.4	0.37	0.3
Dudleyville	88	21	55.1	0.55	
Fish Creek	......	......	......	0.99	
Flagstaff	70	0	35.6	2.98	32.5
Fort Apache	78	19	46.9	2.02	T.
Fort Huachuca	81	18	52.0	1.00	
Fredonia	71	9	40.8	1.20	7.0
Gilabend	92	30	57.4	1.10	
Grand Canyon	78	8	47.4	3.50	26.0
Greaterville	80	16	51.4	0.88	1.0
Greer	......	......	......	1.60	16.0
Holbrook	80	10	44.0	1.22	3.5
Huachuca Res	......	......	......	2.15	
Jerome	77	23	49.0	2.90	0.7
Keams Canyon	72	9	39.6	2.33	18.6
Maricopa	93	24	56.9	1.20	
Mesa	97	25	58.0	1.33	
Natural Bridge	......	......	......	3.60	17.0
Nutrioso	......	......	......	1.98	18.0
Oracle	78	24	56.9	1.56	2.0
Paradise	89	4	50.6	1.77	6.0
Parker	96	24	57.1	0.20	
Phoenix (Ex. Farm)	97	27	57.0	1.26	
Picacho *[5]	88	40	63.8	0.90	
Pinal Ranch	......	......	......	1.48	T.
Prescott	76	10	41.4	2.90	21.3
Roosevelt	86	29	59.0	0.73	
St. Michaels	65	0	36.5	1.37	9.1
San Carlos	89	21	55.0	0.75	
San Simon	85	19	50.5	1.16	2.0
Seligman	78	5	40.7	1.55	11.0
Sentinel *[1]	92	36	59.9	0.88	
Signal	90	30	60.2	0.87	
***Arizona*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Tempe	91	24	57.0	1.24	
Thatcher	87	19	52.8	0.87	
Tuba	77	14	44.6	2.92	25.1
Tucson	92	27	57.8	0.74	
Upper San Pedro	87	17	52.8	0.81	
Vail *[5]	98	40	68.0	0.74	
Walnut Grove	......	......	......	3.30	3.0
Willcox	88	16	50.3	0.78	2.3
Yarnell	......	......	......	2.90	8.0
Young	84	11	46.8	1.22	9.0
Arkansas.					
Alicia	76	20	47.0	3.80	
Amity	......	......	......	4.82	
Arkadelphia	83	28	52.4	5.00	
Arkansas City	......	......	......	8.32	
Batesville	79	22	48.8	5.11	
Beebranch	82	18	48.9	2.25	
Black Rock	......	......	......	7.02	
Brinkley	84[d]	25	52.0[e]	9.09	
Calico Rock	......	......	......	4.10	
Camden	......	......	......	5.25	
Center Point	88	26	54.6	4.60	
Clarendon	......	......	......	10.08	
Conway	82	25	48.6	4.75	T.
Corning	79	17	47.2	6.69	1.8
Dardanelle	......	......	......	2.97	
Des Arc	85	25	51.2	8.25	T.
Dodd City	76	20	46.1	2.30	0.2
Dutton	75	18	46.5	3.15	0.3
Earl	79	28	49.4	10.59	
Eldorado	84	29	54.2	9.00	
Eureka Springs	77	20	46.8	3.60	
Fayetteville	77	20	47.8	2.65	1.8
Forrest City	79	25	50.2	8.39	
Fulton	......	......	......	4.84	
Hardy	77	19	47.2	5.64	T.
Harrison	78	16	45.2	2.81	
Heber	82	23	49.0	4.01	
Helena	82[e]	26	53.8[e]	16.69	
Hope	86	29	54.6	5.26	
Hot Springs	82	24	50.3	4.72	
Huntsville	77	20	47.0	3.07	1.3
Jonesboro	......	......	......	6.72	
Junction	84	25	54.2	......	
La Crosse	79	23	49.5	......	
Lewisville	86	27	53.7	2.79	
Lutherville	80[d]	20	48.0	3.50	T.
Luxora	......	......	......	8.00	
Malvern	81	26	49.0	5.50	
Mammoth Springs	77	14	45.2	5.30	T.
Marked Tree	......	......	......	11.22	
Marvell	84	24	51.6	11.42	
Mena	78	25	51.0	2.50	T.
Montrose	85	29	54.6	9.38	
Mount Nebo	73	26	48.8	3.01	T.
Mossville	75	23	46.6	......	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arkansas—Cont'd.	°	°	°	Ins.	Ins.
Newport	......	......	......	7.36	
Ozark	87	22	50.7	2.83	0.2
Pinebluff	80	30	50.4	10.96	
Pocahontas	80	18	48.4	7.36	
Pond	78	13	46.0	2.09	0.5
Prescott	86	28	52.6	5.50	
Princeton	87	25	52.6	5.06	
Rison	83	27	51.8	8.44	
Rogers	77	17	47.4	2.73	1.2
Russellville	77	24	47.8	3.45	
Spielerville	79	24	51.3	3.18	
Stuttgart	81	28	51.0	7.85	
Texarkana	87	31	55.1	3.25	
Warren	84	26	53.8	8.81	
White Cliffs	......	......	......	2.69	
Wiggs	83	22	50.2	5.38	
Winchester	85	29	53.4	6.89	
Witts Springs	75[1]	20[1]	45.2[1]	......	
California.					
Alturas	72	5	36.3	0.97	3.5
Angiola	91	20	53.1	......	
Auburn	81	31	59.5	2.22	
Azusa	95	29	56.0	0.98	
Bagdad	90	32	61.3	0.40	
Bakersfield	82	27	52.0	0.75	
Bear Valley	......	......	......	4.97	4.0
Berkeley	73	37	54.2	1.64	
Bishop	89	11	44.0	0.30	3.0
Blue Canyon	69	20	42.6	5.05	
Bodie	71	−12	26.9	1.67	29.5
Branscomb	77	24	47.2	6.63	1.0
Brush Creek	70	24	44.6	5.07	T.
Butte Valley	......	......	......	3.31	1.0
Calexico	90	32	59.9	0.19	
Campbell	80	29	51.4	0.61	
Campo	......	......	......	3.23	4.0
Cedarville	66	8	36.3	1.51	3.0
Chico	82	21	51.8	0.88	
Claremont	96	30	57.3	1.12	
Cloverdale	80	27	54.4	2.10	
Colfax	82	18	47.1	3.88	
Colusa	78	29	53.0	0.83	
Craftonville	......	......	......	3.09	11.0
Crescent City	63	32	49.3	8.12	
Crockers	......	......	......	2.60	
Cuyamaca	70	13	38.5	3.68	27.0
Delta	76	29	51.0	3.83	
Diamond	......	......	......	2.82	
Dobbins	81	32	53.6	2.85	
Durham	80	26	53.6	1.31	
Elcajon	98	25	58.3	1.52	
Electra	80	29	54.0	3.34	
Elmwood	78	29	57.0	0.60	
Elsinore	94	22	50.2	2.99	T.
Emigrant Gap	68	22	40.0	5.80	5.0
Escondido	91	20	53.0	1.34	
Folsom	78	24	53.3	1.56	
Fordyce	......	......	......	5.60	30.0
Fort Bragg	......	......	......	1.55	
Fort Ross	68	36	51.4	2.83	
Georgetown	78	26	47.8	3.52	
Gilroy (near)	89	21	50.8	1.37	
Gold Run	80	30	50.6	3.00	
Grass Valley	......	......	......	3.71	
Greenville	69	16	41.1	3.50	0.5
Groveland	......	......	......	1.30	
Healdsburg	98	26	55.5	2.74	
Heber	100	28	61.4	0.15	
Hollister	83	20	51.7	1.07	
Indio	98	28	61.2	0.60	
Idylwild	74	10	42.1	2.15	26.5
Imperial	98	28	60.7	0.50	
Iowa Hill	81	29	49.7	3.62	
Isabella	......	......	......	0.37	4.0
Jamestown	72	22	47.8	1.52	
Kennedy Gold Mine	......	......	......	2.50	
Kentfield	......	......	......	2.57	
Kernville	......	......	......	0.50	5.5
King City	89	17	53.8	1.13	
Laporte	80	17	39.8	7.71	4.0
Legrande	78	25	47.4	0.25	
Lemoncove	87	29	55.2	0.70	
Lick Observatory	68	25	43.7	1.92	4.0
Livermore	85	25	53.5	1.34	
Lodi	76	25	51.2	1.09	
Lone Pine	81	16	44.6	0.20	1.5
Los Gatos	78	32	51.6	1.76	
Low Observatory	......	......	......	1.04	T.
Magalia	71	20	42.4	6.85	T.
Mammoth	97	29	68.8	......	
Marysville	79	28	54.4	1.23	
Mena	91	30	59.0	0.50	
Merced	81	21	52.0	0.20	
Mercury	......	......	......	2.34	
Mills College	......	......	......	2.05	
Milton (near)	74	29	52.7	1.04	
Mohave	80	25	49.6	0.65	6.5
Mokelumne Hill	74	28	51.3	2.35	
California—Cont'd.	°	°	°	Ins.	Ins.
Mono Ranch	82	19	46.0	0.27	3.5
Montague	69	18	41.8	1.04	
Monterio	82	22	50.4	0.99	
Monumental	66	24	42.4	13.27	
Mount St. Helena	......	......	......	4.05	3.2
Napa	81	31	54.9	1.74	
Needles	86	25	55.0	0.50	
Nevada City	81	19	46.0	3.50	
Newcastle	79	27	51.9	2.08	
Newman[4]	77	22	52.0	0.95	
Niles	78	32	53.3	1.97	
Nimshew	72	28	49.1	4.83	0.2
North Bloomfield	79	23	45.0	3.72	T.
Oakland	72	36	54.4	1.22	
Ojai Valley	100	25	56.8	0.12	
Orleans	80	25	53.2	4.84	
Oroville (near)	75	29	52.7	1.44	
Ozena	......	......	......	0.37	
Palermo	79	27	52.8	1.46	
Pilot Creek	......	......	......	4.65	T.
Pine Crest	93	38	61.0	0.44	
Placerville	74	20	46.3	2.69	
Point Lobos	73	46	58.2	0.87	
Porterville	79	26	52.8	0.30	
Poway	93	22	56.6	1.16	
Priest Valley	......	......	......	1.79	
Quincy	60	16	36.8	3.34	1.0
Redding	79	29	52.8	2.51	
Redlands	95	28	54.8	2.72	
Reedley	80	27	50.9	0.60	
Represa	......	......	......	1.77	
Rialto	96	30	56.8	2.60	7.7
Riovista	79	26	53.6	1.26	
Riverside	95	27	53.6	2.23	
Rocklin	79	22	53.0	1.40	
Sacramento	75	27	51.4	1.31	
Salinas	84	28	52.8	1.00	
San Bernardino	99	25	54.4	2.42	
San Jacinto	99	24	55.3	2.43	
San Leandro	80	30	55.2	1.73	
Santa Barbara	85	34	56.4	0.35	
Santa Clara College	81	27	53.0	1.02	
Santa Cruz	84	27	53.4	2.30	
Santa Maria	90	28	56.5	0.63	
Santa Monica	83	36	55.1	0.92	
Santa Rosa	83	25	53.2	1.88	
Sausalito	......	......	......	1.40	
Shasta	85	29	53.3	2.80	
Sierra Madre	90	36	58.5	1.31	
Sisson	66	19	39.0	4.52	4.0
Snedden	......	......	......	0.65	4.0
Sonoma	82	26	55.6	1.50	
Sterling	77	25	43.8	6.42	0.5
Stockton	77	25	51.6	1.01	
Storey	75	22	48.8	0.96	
Summerdale	77	16	41.8	1.99	3.0
Summit	67	10	31.8	2.04	18.0
Susanville	66	11	37.4	1.91	T.
Tamarack	66	−6	30.0	8.25	82.5
Towle	87	23	46.6	5.07	
Truckee	68	5	39.4	0.98	9.0
Tulare	78	25	50.6	0.45	
Tustin (near)	......	......	......	1.32	
Ukiah	79	22	50.2	1.32	
Upland	87	30	53.8	0.75	
Upperlake	82	22	51.1	1.36	
Upper Mattole	......	......	......	7.86	
Vacaville	86	24	54.5	1.41	
Visalia	86	30	57.0	0.48	
Wasco	88	23	50.8	0.52	
Wasioja	......	......	......	0.50	2.0
Westpoint	......	......	......	2.40	
West Saticoy	......	......	......	0.25	
Wheatland	77	27	51.2	2.17	
Willows	76	25	53.1	0.82	
Woodleaf	......	......	......	4.78	
Woodside	76	31	52.3	2.16	
Yosemite	67	18	40.0	1.55	1.0
Yreka	......	......	......	2.47	
Zenia	72	26	45.4	6.08	T.
Colorado.					
Akron	......	......	......	1.56	
Antelope Springs	58	−28	25.4	2.39	25.0
Arriba	77	3	37.0	0.40	2.2
Ashcroft	58	−10	27.1	2.17	26.5
Blaine	75	−4	37.8	0.85	6.0
Boulder	73	3	38.6	1.87	18.0
Breckenridge	54	−17	26.0	1.10	13.5
Buena Vista	62	−12	30.3	0.65	8.0
Burlington	76	4	37.2	0.23	
Canyon	72	−2	41.5	0.53	2.3
Castlerock	72	−9	34.8	0.57	6.0
Cheesman	69	0	37.6	0.61	4.0
Cheyenne Wells	75	8	39.6	0.20	T.
Chromo	65	9	35.6	1.40	3.0
Clearview	62	−9	30.6	0.43	6.5
Collbran	65	0	35.1	1.16	9.2
Colorado Springs	69	−6	36.4	0.35	3.5
Colorado—Cont'd.	°	°	°	Ins.	Ins.
Cope	71	5	36.8	1.05	6.6
Cripplecreek	......	......	......	0.16	2.5
Dunkley	57	−11	28.9	1.74	7.5
Eagle	65	−1	35.4	0.44	
Fort Collins	70	−9	33.6	......	......
Fort Morgan	72	2	36.6	0.56	1.0
Fowler	......	......	......	0.80	3.0
Frances	53	−9	30.4	1.68	13.0
Fruita	67	6	38.6	1.19	3.6
Garnett	62	−7	32.2	0.31	3.5
Gleneyre	73	−8	35.3	0.24	3.0
Gothic	55	−11	26.9	2.16	2.0
Grand Valley	68	4	38.4	1.80	7.5
Greeley	70	−2	36.9	0.93	8.0
Grover	......	......	......	0.90	
Gunnison	69	−4	32.8	0.19	1.0
Hahns Peak	65	−18	35.2	1.20	12.5
Hamps	69	−5	34.0	0.38	5.5
Hoehne	75	−11	35.4	0.70	4.0
Holly	78	7	40.5	0.78	T.
Holyoke (near)	79	2	35.6	0.71	3.0
Idaho Springs	62	0	34.0	0.58	3.5
Lake City	60	−11	30.5	0.71	16.5
Lake Moraine	53	−13	27.2	0.55	8.0
Lamar	77	5	41.4	0.82	4.5
Laporte	......	......	......	1.74	17.5
Las Animas	79	1	39.8	0.21	
Lay	61	−18	27.4	0.55	6.8
Leroy	66	5	35.7	1.29	5.5
Longs Peak	53	−17	27.2	1.12	15.0
Lujane	63	6	37.6	1.05	6.0
Manassa	64	−13	31.8	0.55	6.0
Mancos	66	−3	37.5[d]	2.54	20.5
Meeker	69	−14	32.2	1.74	14.5
Montrose	69	7	37.4	0.63	6.0
Moraine	58	−8	31.5	1.54	16.0
Pagoda	62	−12	31.1	1.09	7.0
Pavonia	69	7	39.6	1.50	7.0
Platte Canyon	......	......	......	1.05	6.0
Rangely	71	−6	35.5	1.73	15.5
River Portal	60	9	35.8	1.07	3.6
Rockyford	78	−1	39.4	0.22	T.
Saguache	63	−8	31.0	......	
Salida	65	−3	34.2	1.65	13.0
San Luis	63	−1	34.6	0.40	1.0
Santa Clara	66	−6	35.7	1.18	12.0
Sapinero	57	−7	29.5	1.55	12.3
Sheridan Lake	77	4	36.6	0.45	0.5
Silt	65	2	36.8	1.13	4.0
Silverton	57	−22	28.0	2.22	28.2
Stonewall	......	......	......	0.41	6.0
Sugar City	......	......	......	0.33	2.5
Trinidad	71	4	39.6	1.10	7.5
Victor	62	−6	36.5	0.48	4.4
Vilas	......	......	......	1.26	8.0
Wagon Wheel	63	−26	26.6	3.53	43.0
Waterdale	72	−7	35.2	1.28	6.0
Westcliff	64	−12	33.2	0.71	10.0
Whitepine	50	−9	25.2	0.75	10.0
Wray	74	9	38.3	0.83	5.0
Yuma	......	......	......	1.17	T.
Connecticut.					
Bridgeport	64	24	43.0	2.81	0.8
Canton	59	17	38.2	2.36	6.0
Colchester	64	19	39.8	2.65	3.0
Falls Village	......	......	......	1.69	3.2
Hawleyville	63	19	39.8	1.85	3.0
Lake Konomoc	......	......	......	3.37	
New London	65	23	43.1	2.53	
North Grosvenor Dale	66	16	38.8	2.04	T.
Norwalk	64	18	40.4	1.71	2.0
Southington	64	19	40.3	2.40	4.0
South Manchester	......	......	......	2.61	3.0
Storrs	65	19	39.6	2.39	
Voluntown	67	16	41.4	1.65	1.0
Wallingford	67	13	34.5	1.95	4.5
Waterbury	64	21	41.1	2.18	5.5
West Cornwall	59	14	36.8	1.36	7.5
West Simsbury	......	......	......	2.78	6.0
Delaware.					
Delaware City	......	......	......	2.14	2.0
Dover	72	25	46.1	2.28	
Milford	73	23	47.0	2.22	T.
Millsboro	75	22	46.5	1.03	
Newark	66	25	45.0	2.81	0.5
Seaford	68	27	45.4	1.45	
District of Columbia.					
West Washington	76	26	46.2	1.85	T.
Florida.					
Apalachicola	81	34	64.2	1.06	
Archer	91	28	65.4	0.20	
Avon Park	99	33	69.1	0.05	
Bartow	86	32	67.9	0.28	
Bonifay	82	27	62.0	1.90	
Brooksville	91	33	68.2	0.59	
Clermont	87	37	69.4	0.25	
De Funiak	82	25	62.4	2.73	
Deland	88	22	66.2	......	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Eustis	89	33	66.7	0.46	
Federal Point	87	33	66.0	0.06	
Fenholloway	88	28	63.6	1.49	
Fernandina	83	36	65.4	T.	
Fort Meade	89	28	67.2	0.08	
Fort Myers	86	43	69.6	0.32	
Fort Pierce	83	35	71.0	4.27	
Gainesville	90	29	65.7	0.11	
Grasmere	84	37	64.9		
Huntington	86	34	64.6	0.40	
Hypoluxo	84	37	72.8	4.40	
Inverness	89	33	67.4	0.60	
Jasper	88	29	65.0	0.00	
Johnstown	88	28	61.2	0.04	
Kissimmee	85	33	66.7	0.16	
Macclenny	88	28	62.6	0.00	
Madison	87	29	63.2	0.81	
Malabar	85	35	71.6	1.06	
Manatee	87	38	68.8	0.75	
Marianna	85	26	60.4	1.90	
Merritt Island	81	41	70.2	0.56	
Miami	83	42	72.4	7.52	
Middleburg	86	29	62.4	0.01	
Molino				0.65	
Monticello	83	28	62.0	0.82	
Mount Pleasant	......	......	......	1.43	
Ocala	90	31	67.2	0.45	
Orange City	92	29	66.5	0.00	
Orange Home	89	32	67.8	0.49	
Orlando	87	34	67.8	0.23	
Plant City	90	32	68.0	0.40	
Rockwell	86[d]	34[d]	66.8[d]	0.86	
St. Andrew	80	28	61.8	0.61	
St. Augustine	84	34	65.9	0.00	
St. Leo	87	33	67.4	0.70	
Stephenville	89	30	62.9	1.10	
Switzerland	88	34	64.4	0.02	
Tallahassee	81	29	62.0	1.30	
Tarpon Springs	90	37	67.5	1.13	
Wausau	84	25	62.6	1.45	
Georgia.					
Abbeville	......	......	......	0.74	
Adairsville	70[e]	23[e]	51.4	62.3	2.5
Albany	83	28	59.4	1.17	
Allapaha	86	28	58.0	0.53	
Americus	79[d]	27[d]	56.5[d]	1.22	
Athens	74	28	51.8	1.91	2.0
Bainbridge	84	24	60.0	0.66	
Blakely				0.75	
Brunswick	87	33	61.7	0.10	
Butler				1.52	
Camak	80	24	54.4	1.18	T.
Canton				2.79	
Carlton				1.02	
Clayton	73	19	48.6	4.20	4.0
Columbus	80[e]	30[e]	55.8[e]	2.42	
Cordele	84	28	57.6	0.88	
Covington				2.17	
Cuthbert	83	25	59.0	1.49	
Dahlonega	74	19	51.2	1.97	3.0
Dawson	82[l]	29[l]	57.0[l]	0.82	
Diamond	72	19	49.5	4.40	3.0
Dublin				1.20	
Dudley	82	28	56.6	0.89	
Eastman	85	28	56.8	0.55	
Eatonton	80	25	55.0	1.52	
Elberton	77	20	53.0	1.32	1.0
Experiment	77	27	54.1	2.10	
Fitzgerald	83	26	58.5	0.57	
Fleming	83	26	57.3	0.44	
Forsyth	81	27	56.5	1.24	
Fort Gaines	80	29	57.6	1.13	
Gainesville	71	26	50.4	0.95	3.5
Gillsville	77	23	52.7	1.38	2.5
Glenville	82	29	56.7	0.46	
Greenbush	74	24	49.9	5.24	3.0
Greensboro	80	24	51.6	1.49	
Griffin	79	26	56.6	2.60	
Harrison	83	23	55.8	1.03	
Hawkinsville	86	25	56.0	1.35	
Lisbon	81	22	51.6	0.73	T.
Lost Mountain	76	23	53.4	2.35	2.0
Louisville	87	27	57.0	1.08	
Lumpkin	82[k]	25[k]	59.6[k]	1.75	
Marshallville	82[e]	24[e]	59.0[e]	0.45	
Mauzy	83[l]	26[k]	58.1[l]	0.83	
Milledgeville	80	25	53.4	0.78	
Millen	85	23	54.0	0.55	
Montezuma				1.14	
Monticello	79	27	54.6	1.66	
Morgan	80	28	58.3	1.38	
Newnan	79	26	54.2	0.54	
Oakdale				1.34	T.
Point Peter	78	22	51.1	1.31	
Poulan	85	26	58.6	0.65	
Putnam	80	28	57.0	1.03	
Quitman	84	29	60.4	0.52	
Ramsey	76	22	52.8	8.68	2.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Resaca	......	......	......	6.84	4.0
Rome	77	22	50.8	7.80	4.5
St. George	85	30	60.5	T.	
St. Marys	83	31	61.8	0.02	
Screven	88[f]	27[f]	59.9[f]	0.60	
Statesboro	......	......	......	0.60	
Talbotton	81	25	56.0	2.05	
Tallapoosa	79	22	53.6	1.99	T.
Toccoa	75	23	50.3	1.98	2.5
Valdosta	87	25	60.6	0.06	
Valona	81	28	56.4	0.40	
Washington	75	26	52.0	1.42	T.
Waycross	86	30	57.6	0.52	
Waynesboro	82	27	58.0	1.04	
Westpoint	80	26	53.6	3.57	
Woodbury	77	24	52.4	2.31	
Idaho.					
American Falls	68	— 2	33.6	0.95	......
Bannock River Cabin	63	— 5	32.8	0.94	3.2
Blackfoot	68	0	33.0	0.90	6.0
Buhl				0.92	4.9
Caldwell	70	6	38.4	0.66	3.5
Cambridge	66	6	36.8	2.46	3.0
Chesterfield	62	— 9	31.6	0.88	2.0
Dent	56	16	37.1	7.68	9.7
Dewey	65	— 5	29.2	2.86	23.4
Ellerslie	65	6	35.3	1.28	4.0
Emmett	71	9	38.6	1.10	1.5
Forney	59	—13	26.8	3.84	13.2
Garnett	71	12	41.0	T.	
Hot Springs	73	5	39.6	0.34	1.5
Idaho Falls	63	— 5	32.0	0.62	4.5
Kellogg	59	6	34.8[c]	5.95	7.8
Lake	58	— 4	29.2	1.14	8.9
Lakeview	56	14	35.2	6.05	10.0
Landore	51	5	29.4	6.34	20.0
Lardo	53	— 1	29.7	4.23	7.2
Lost River	66	— 4	30.6	0.70	4.4
Lovell	55	— 4	31.2	5.15	4.0
Meadows	56	4	32.0	3.31	4.9
Milner	69	0	34.0	1.24	11.2
Moscow	53	9	35.2	7.48	......
Mountain Home	68	— 7	33.9	0.67	5.5
Murray	58	2	30.4	7.96	11.0
Murtaugh	72[e]	— 5[e]	33.6[e]	0.87	4.0
Nevens Ranch	......	......	......	1.15	1.5
Oakley	69	—10	34.0	0.83	9.0
Orofino	60	17	38.8	6.36	5.0
Paris	......	......	......	0.48	2.2
Payette	71	5	37.7	0.53	2.2
Pollock	62	16	39.4	3.11	
Poplars	......	......	......	0.74	3.0
Porthill	55	11	33.2	4.00	10.0
Roosevelt	46[f]	— 6[f]	24.4[f]	4.33	5.5
St. Maries	58	5	35.6	6.78	5.2
Salem	......	......	......	1.82	15.0
Salmon	60	1	30.5	1.01	1.2
Standrod	......	......	......	1.30	11.6
Twin Falls	69	— 4	34.4	1.00	10.9
Vernon	59	— 5	30.7	1.35	9.0
West Lake	......	......	......	3.91	......
Weston	67	— 7	34.9	1.33	5.5
Illinois.					
Albion	67	24	43.8	5.45	......
Aledo	71	10	37.0	3.12	4.4
Alexander	72	19	40.5	3.02	0.6
Antioch	64	20	37.8	3.30	T.
Ashton	68	15	36.6	2.79	1.6
Astoria	74	17	38.9	2.20	1.0
Aurora	65	19	37.8	2.64	T.
Benton	74	20	45.4	7.75	2.0
Bloomington	74	22	41.0	3.80	T.
Bushnell	74	14	38.8	1.80	2.0
Cambridge	73	13	37.9	3.53	5.5
Carlinville	75	16	41.5	3.94	1.0
Carlyle	......	......	......	4.90	3.5
Carrollton	78[g]	22	39.9[d]	3.82	0.2
Charleston	69	21	41.8	4.34	
Chester	72	30	45.6	4.76	5.4
Cisne	76	23	44.2	4.50	2.0
Coatsburg	72	14	38.6	1.86	0.5
Cobden	75	20	45.2	7.75	3.0
Colchester	71	15	38.7	2.33	1.0
Decatur	73	19	39.7	4.63	T.
Dixon	71	16	35.9	2.19	......
Dwight	72	20	39.2	2.80	0.7
Elgin	68	19	37.8	3.29	T.
Equality	75	21	46.2	7.75	3.5
Flora	69[e]	22[e]	42.4[e]	5.71	7.5
Friendgrove	66	25	43.8	5.97	1.5
Galva	72	13	36.2	2.09	2.5
Grafton	......	......	......	3.92	2.0
Greenville	76	19	43.1	4.25	1.5
Griggsville	73	21	41.6	2.70	T.
Halfway	75	20	44.8	6.40	T.
Havana	73	22	40.4	2.37	T.
Henry	72	19	39.2	2.56	1.0
Hillsboro	75	25	42.6	4.25	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hoopeston	68	20	40.0	5.55	1.9
Joliet	67	22	38.8	2.63	1.0
Kishwaukee	70	9	36.4	2.56	0.8
Knoxville	72	13	37.3	2.65	4.1
Lagrange	65	20	38.0	2.69	0.5
Laharpe	73	10	38.5	1.15	2.0
Lanark	67	8	35.6	3.48	5.0
Lincoln	72	24	41.6	3.58	......
Loami	......	......	......	3.50	T.
McLeansboro	70	20	43.7	5.32	1.0
Martinsville	76	20	43.2	4.65	T.
Martinton	74	20	40.2	3.25	T.
Minonk	70	19	38.6	2.04	T.
Monmouth	74	12	37.6	2.67	3.5
Morrison	70	10	37.2	3.17	4.0
Morrisonville	72	18	40.8	3.92	T.
Mount Carmel	......	......	......	7.60	4.0
Mount Vernon	73	18	43.6	6.90	2.0
New Burnside	76	19	45.0	8.33	3.0
Olney	73	24	43.8	5.55	1.2
Ottawa	71	20	40.0	2.63	T.
Palestine	70	19	42.4	5.05	T.
Pana	68	21	41.2	4.86	T.
Paris	75	20	41.8	3.80	......
Philo	69	21	39.9	4.75	T.
Pontiac	70	21	40.2	2.58	T.
Rantoul	74	21	41.2	4.91	0.2
Raum	75	25	46.1	7.68	2.0
Riley	65	18	37.5	2.52	2.6
Robinson	71	24	42.8	4.81	1.6
Rushville	74	18	40.8	2.24	2.0
St. Charles	66	19	37.6	3.11	2.0
St. John	75	17	43.4	6.40	T.
Streator	72	21	39.8	2.75	T.
Sullivan	73	21	41.0	3.84	......
Sycamore	68	19	36.6	3.40	T.
Tilden	75	20	43.6	5.70	2.0
Tiskilwa	74	14	38.6	2.97	3.5
Tuscola	74	21	41.1	3.94	T.
Urbana	70	20	40.2	4.59	T.
Vernon	76	17	42.3	5.42	1.2
Walnut	73	18	38.8	2.79	0.8
Warsaw	......	......	......	2.28	4.0
Windsor	71	20	40.8	3.50	2.7
Winnebago	68	17	36.8	2.85	3.7
Yorkville	64	19	37.5	1.44	T.
Zion	66	13	36.2	1.79	......
Indiana.					
Anderson	67	20	41.4	3.18	T.
Angola	62	22	39.0	3.49	2.5
Auburn	64[e]	17[h]	36.8[h]	......	
Bedford	75	26	51.2	5.40	T.
Bloomington	68	25	46.4	4.90	T.
Bluffton	68	16	39.6	3.52	1.5
Butlerville	72	23	44.0	5.14	0.2
Cambridge City	70	16	39.4	3.59	
Columbus	71	19	43.0	4.43	0.2
Connersville	70	16	41.4	4.01	T.
Crawfordsville	70	20	40.9	3.65	T.
Delphi	70	18	38.6	3.69	1.2
Elkhart	68	24	39.8	3.38	0.2
Farmersburg	73	22	43.6	3.61	T.
Farmland	66	20	41.2	3.15	
Fort Wayne	65	21	40.0	3.86	0.6
Franklin	71	18	42.2	3.77	T.
Greenfield	67	22	42.7	4.65	
Greensburg	75	21	44.1	4.64	0.4
Hammond	67	24	40.0	2.02	......
Holland	75[e]	23[e]	43.4[e]	4.68	1.0
Huntington	65	23	40.4	3.78	
Jeffersonville	77	26	46.0	6.69	4.0
Knox	65	15	39.1	4.78	11.6
Kokomo	68	19	40.2	3.06	T.
Lafayette	70	23	40.0	3.31	T.
Laporte	70	2	38.0	3.85	9.8
Lima	65	22	38.2	3.21	0.5
Logansport	71	22	40.4	3.64	T.
Madison	74	22	44.8	4.19	T
Marengo	72	19	43.7	4.16	2.0
Marion	67	20	40.4	3.73	T.
Markle	68	18	37.8	3.20	1.0
Mauzy	69	17	41.2	4.32	0.5
Moores Hill	72	23	43.6	3.29	1.0
Mount Vernon	75	24	45.3	6.30	0.2
Northfield	66	14	38.2	3.04	T.
Paoli	73	22	44.1	4.67	2.0
Plymouth	66	20	38.0	4.16	6.1
Princeton	72	24	44.6	5.70	3.0
Rensselaer	74	15	39.6	4.30	5.5
Richmond	68	15	40.2	3.05	T.
Rochester	59	22	39.0	3.99	T.
Rockville	70	23	41.8	3.63	T.
Rome	78	21	47.1	6.92	3.0
Salamonia	65	18	40.2	2.99	T.
Salem	73	16	42.5	5.34	2.0
Scottsburg	74	23	46.0	4.47	1.5
Seymour	74	21	43.0	4.44	
Shelbyville	69	20	41.7	4.17	T.

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Indiana—Cont'd.					
South Bend	69	20	39.4	3.57	3.0
Syracuse	67	20	38.9	3.73	1.0
Terre Haute	70	27	44.2	3.80	T.
Veedersburg	70	20	41.0	2.93	
Vevay	72	25	45.5	4.15	1.5
Vincennes	72	22	43.2	5.62	T.
Washington	73	25	43.5	5.39	T.
Worthington	70	20	42.2	4.99	
Indian Territory.					
Ardmore	86	18	52.5	1.02	1.0
Calvin	.....	.....	.....	1.32	1.0
Durant	84	22	51.4	0.76	T.
Fairland	78[e]	17[e]	47.5[e]	1.79	3.0
Fort Gibson	.....	.....	.....	1.55	1.2
Healdton	85	14	50.2	0.71	2.0
Marlow	81	17	47.4	1.79	T.
Muskogee	79	22	49.0	1.73	1.0
Okmulgee	84	19	48.2	0.42	1.5
Pauls Valley	84	14	50.5	0.25	2.0
Ravia	85	20	53.2	1.25	3.5
South McAlester	84	25	53.4	0.60	1.0
Tulsa	80	18	46.8	1.13	2.2
Vinita	78	13	45.2	1.55	2.5
Wagoner	79	20	47.8	0.95	1.0
Webbers Falls	85	23	49.6	1.70	0.5
Iowa.					
Afton	72	12	36.8	1.90	5.0
Albia	92	9	36.0	2.52	8.5
Algona	64	9	33.5	1.74	4.2
Allerton	75	5	37.4	2.80	10.6
Alta	63	11	32.8	1.42	2.0
Alton	65	11	33.6	0.56	1.1
Amana	71	7	36.2	3.15	6.0
Ames	73	1	35.7	1.74	3.2
Atlantic	70	7	36.5	1.53	3.0
Audubon	68	10	35.0	1.02	3.2
Baxter	73	4	35.4	3.05	7.5
Bedford	74	6	36.5	2.05	5.8
Belleplaine	70	4	34.6	3.12	8.7
Bloomfield	75	12	37.3	2.41	6.0
Bonaparte	74	10	38.0	2.25	2.5
Boone	73	11	34.8	1.63	3.6
Britt	70	6	33.8	2.03	3.1
Buckingham	.....	.....	.....	2.62	4.5
Burlington	75	14	37.7	3.04	5.0
Carroll	69	12	33.8	0.97	3.0
Cedar Rapids	70	9	55.0	2.71	3.0
Chariton	75	4	36.6	2.15	10.0
Clarinda	72	10	36.0	1.32	3.8
Clearlake	70	13	34.0	1.65	3.0
Clinton	69	15	37.1	3.46	3.0
College Springs	73	12	36.3	1.06	2.4
Columbus Junction	70	13	37.4	2.56	3.0
Corning	72	11	35.6	1.63	4.0
Corydon	76	8	37.8	2.32	10.0
Creston	73	8	35.0	1.20	3.5
Cumberland	.....	.....	.....	1.32	5.0
Decorah	68	3	34.6	2.65	8.0
Delaware	66	8	34.0	2.80	5.0
Denison	53	10	35.7	1.14	2.0
Desoto	73	6	37.1	1.61	2.5
Dows	72	4	33.7	2.37	3.7
Earlham	72	9	35.8	1.67	4.5
Elkader	.....	.....	.....	3.61	5.5
Elliott	74	12	37.4	0.62	2.0
Estherville	68	10	32.4	1.49	3.0
Fayette	70	2	33.1	3.12	5.0
Forest City	69	10	32.8	1.11	0.5
Fort Dodge	70	10	34.2	2.20	3.0
Fort Madison	.....	.....	.....	2.64	7.0
Galva	62	10	33.8	0.85	3.5
Gilman	.....	.....	.....	3.11	4.5
Grand Meadow	67	5	33.8	2.84	5.8
Greenfield	72	13	36.6	2.63	4.6
Grinnell (near)	74	4	35.0	3.35	6.5
Grundy Center	72	0	34.6	1.55	4.5
Guthrie Center	70	10	35.9	1.82	3.0
Hampton	72	10	34.1	2.89	3.8
Hancock	68	15	37.0	0.86	3.0
Harlan	69	9	35.4	1.01	3.5
Hopeville	74	9	37.2	1.79	2.5
Humbolt	68	8	35.2	1.40	4.0
Independence	.....	.....	.....	4.15	.....
Indianola	72	10	37.2	3.20	7.5
Inwood	65	8	32.1	0.48	1.7
Iowa City	72	8	35.4	3.08	4.0
Iowa Falls	71	1	34.1	2.35	6.0
Jefferson	72	10	36.0	1.48	2.8
Keosauqua	75	12	37.2	2.13	3.2
Knoxville	74	10	37.6	2.38	7.5
Lacona	.....	.....	.....	2.77	10.0
Larrabee	64	10	33.2	1.01	3.0
Leclaire	.....	.....	.....	2.85	2.0
Lemars	65	11	33.4	0.53	T.
Lenox	73	12	36.7	1.73	4.5
Leon	73	10	37.0	3.82	10.7
Little Sioux	67	13	36.5	0.68	2.5
Logan	68	13	36.2	0.89	3.0
Iowa—Cont'd.					
Maple Valley	.....	.....	.....	1.68	2.5
Marshalltown	73	1	33.6	1.77	6.3
Mason City	69	13	36.0	2.80	4.0
Massena	70	11	35.8	1.41	3.0
Mountayr	75	10	37.4	2.03	5.5
Mount Pleasant	71	13	37.8	2.47	2.5
Mount Vernon	67	11	35.8	2.61	5.3
Muscatine	.....	.....	.....	2.34	2.0
Nevada	.....	.....	.....	2.82	7.5
New Hampton	65	0	32.5	2.73	6.8
Northwood	67	10	34.0	2.79	5.1
Odebolt	67	13	35.0	0.97	2.5
Ogden	72	10	36.4	1.80	4.5
Olin	67[g]	10[g]	36.2[g]	.....	2.5
Onawa	67	14	36.2	0.50	2.0
Osage	67	3	33.5	2.80	6.9
Oskaloosa	76	4	36.7	2.03	6.5
Ottumwa	72	10	38.2	1.72	.....
Pacific Junction	73	11	37.0	0.71	4.1
Pella	75	10	37.6	2.53	6.5
Perry	72	6	35.8	2.01	5.0
Plover	65	10	33.8	1.52	3.0
Pocahontas	68	12	34.3	1.17	3.1
Preston	64	13	35.0	3.86	2.9
Ridgeway	70	6	35.2	3.69	7.8
Rock Rapids	64	8	33.3	0.79	2.5
Rockwell	70	12	33.7	2.40	5.0
Sac City	66	12	33.5	1.07	2.0
St. Charles	76	13	38.6	1.43	5.5
Sheldon	65	9	32.7	1.21	4.0
Sibley	65	8	31.2	0.96	3.0
Sigourney	73	7	36.8	3.37	5.5
Sioux Center	65	10	32.4	0.55	4.0
Stockport	73	12	38.4	1.79	2.8
Storm Lake	66	9	34.0	1.35	1.3
Stuart	70	15	36.2	1.96	5.0
Thurman	73	14	37.9	0.59	2.5
Tipton	66	13	37.2	2.99	.....
Toledo	72	1	35.4	3.21	6.5
Wapello	63	15	37.8	2.96	3.5
Washington	73	10	36.8	2.32	.....
Washta	66	8	34.2	0.35	2.0
Waterloo	70	2	34.8	2.94	7.5
Waukee	73	10	37.4	2.80	7.0
Waverly	70	3	34.3	3.10	7.8
Webster City	72	4	36.2	1.59	4.0
Westbend	66	11	33.6	1.40	2.0
Whitten	70	3	34.0	2.17	6.0
Wilton Junction	66	9	36.5	2.96	0.3
Winterset	71	14	36.8	2.28	7.0
Woodburn	71	−5	36.0	2.30	9.0
Zearing	72	−3	35.7	2.95	3.0
Kansas.					
Abilene	.....	.....	.....	0.92	T.
Alton	71	9	41.6	0.41	T.
Anthony	79	10	43.4	2.34	6.0
Atchison	74	14	40.0	2.45	10.0
Baker	76	13	40.3	2.07	3.0
Burlington	77	10	43.2	3.65	7.5
Chapman	77	13	42.0	1.15	3.0
Cimarron	73	0	39.2	0.98	3.5
Clay Center	77	13	40.2	1.07	4.5
Colby	72	10	39.2	0.53	0.5
Coldwater	77	0	42.2	1.64	5.5
Columbus	75	16	44.2	2.73	3.3
Coolidge	78	5	38.6	0.55	3.0
Cottonwood Falls	78	5	41.1	2.32	7.7
Cunningham	77	17	44.2	2.15	4.0
Dresden	69	12	40.7	0.24	T.
Eldorado	76	7	42.3	2.98	7.0
Ellinwood	75	7	40.9	1.46	7.5
Ellsworth	78	1	39.9	1.13	4.2
Emporia	76	12	42.1	2.80	9.5
Englewood	78	−1	42.4	1.81	18.0
Enterprise	76	11	41.2	1.23	3.0
Eskridge	74	16	40.9	1.32	5.0
Eureka	.....	.....	.....	4.17	6.0
Fall River	77	10	42.8	4.20	5.0
Farnsworth	80	10	40.8	0.72	T.
Fort Scott	78	18	43.9	2.56	2.0
Frankfort	75	15	40.2	1.20	3.5
Fredonia	79	14	44.4	5.28	3.0
Garden City	78	2	41.6	1.32	4.0
Garnett	76	15	42.0	2.74	6.0
Goodland	74	10	37.0	0.15	T.
Gove*[1]	73	12	40.0	0.65	0.2
Grenola	76	14	42.7	3.57	4.0
Hanover	75	14	39.9	0.57	2.0
Harrison	72	10	39.0	0.12	0.3
Hays	77	3	40.0	0.86	3.2
Horton	75	14	39.8	1.80	3.0
Hoxie	62[k]	10	38.1[e]	0.58	T.
Hugoton	74	−8	40.0	1.08	4.0
Hutchinson	75	10	42.2	2.21	5.0
Independence	77	15	45.4	2.22	4.5
Jetmore	73	2	40.8	0.98	6.0
Jewell	.....	.....	.....	1.07	6.0
La Crosse	70	−2	40.0	0.85	4.0
Kansas—Cont'd.					
Lakin	72	5	39.7	0.71	4.0
Larned	76	−4	39.8	1.44	10.0
Lebanon	69	13	39.4	T.	T.
Lebo	77	10	41.1	3.35	7.0
McPherson	75	14	42.7	1.87	8.5
Macksville	75	2	41.2	1.41	7.0
Madison	78	8	40.2	4.23	7.2
Manhattan *b*	78	14	40.4	1.08	3.8
Manhattan *c*	79	14	40.1	2.21	2.6
Minneapolis	74	12	40.7	1.24	4.0
Moran	77	13	43.6	3.77	6.2
Mounthope	.....	.....	.....	2.59	5.0
Neosho Rapids	.....	.....	.....	3.63	9.0
Ness City	.....	.....	.....	0.70	3.0
Newton	.....	.....	.....	2.00	4.2
Norton	76	13	39.5	0.42	
Norwich	75	13	43.2	2.84	4.0
Olathe	76	12	40.5	3.37	7.0
Osage City	.....	.....	.....	1.67	6.5
Oswego	78	15	44.8	2.00	1.6
Ottawa	78	6	40.8	3.62	10.5
Paola	81[e]	9[e]	42.8[e]	3.27	7.2
Phillipsburg	74	12	42.0	0.54	T.
Plainville	.....	.....	.....	0.66	1.0
Pleasanton	75	12	41.6	2.93	4.0
Pratt	80[h]	8	44.3[d]	1.09	5.0
Republic	72	6	39.6	0.24	3.0
Rome	78	9	43.0	2.87	6.0
Russell	74	−1	40.5	1.06	4.0
Salina	76	11	41.7	1.27	3.0
Scott	76	10	42.0	0.63	0.2
Sedan	76	15	44.0	2.18	3.0
Toronto	78	8	42.6	4.00	3.0
Ulysses	77[h]	−5[e]	39.4[f]	1.18	6.0
Valley Falls	76	10	40.4	3.33	6.3
Wakeeney	77	11	41.2	0.33	T.
Wakeeney (near)	.....	.....	.....	0.30	0.5
Wallace	79	7	40.4	0.91	0.5
Walnut	77	15	43.7	2.87	2.0
Winfield	78	10	42.8	4.15	7.0
Yates Center	79	10	43.4	3.69	4.0
Kentucky.					
Alpha	80	25	47.8	2.85	3.0
Anchorage	77	19	44.0	5.16	4.0
Bardstown	79	23	46.4	7.42	2.0
Beattyville	83	19	44.6	3.39	3.0
Beaver Dam	78	20	45.8	7.72	1.5
Berea	79	22	47.2	2.82	3.0
Blandville	74	23	46.0	8.61	4.0
Bowling Green	79	20	48.2	6.30	5.0
Burnside	80	19	47.8	3.22	0.4
Cadiz	76	19	47.0	8.48	4.0
Calhoun	75	21	47.4	6.53	1.0
Catlettsburg	82	23	46.5	2.68	T.
Earlington	78	20	45.8	7.14	2.0
Edmonton	79	18	46.2	4.13	3.6
Eubanks	80	18	44.8	3.37	3.2
Falmouth	.....	.....	.....	2.96	T.
Farmers	79	18	44.0	2.45	2.0
Frankfort	77	23	45.3	4.29	1.3
Franklin	76	21	48.0	6.28	3.4
Greensburg	82	18	44.0	4.47	2.0
High Bridge	87	25	49.6	4.06	2.0
Hopkinsville	78	18	46.4	10.77	5.3
Irvington	77	25	46.2	6.86	0.5
Jackson	81	23	46.8	3.01	3.0
Leitchfield	77	25	46.4	12.09	1.8
Loretto	93	18	48.8	6.86	0.4
Marion	74	23	47.2	6.13	3.0
Maysville	77	20	43.6	3.69	0.7
Middlesboro	.....	.....	.....	5.31	4.0
Mount Sterling	76	24	44.2	3.09	T.
Owensboro	74	24	46.7	5.56	T.
Owenton	.....	.....	.....	4.81	1.0
Paducah	77	26	48.0	7.85	3.0
Princeton [a]	76	18	46.4	6.98	3.0
Richmond	81	24	46.8	2.19	
St. John	89	19	44.9	8.94	3.0
Scott	74	20	44.6	3.47	2.0
Shelby City	80	11	44.6	3.84	4.0
Shelbyville	78	19	44.6	4.89	4.0
Taylorsville	76	20	44.2	5.66	1.0
West Liberty	81	21	44.6	2.44	2.0
Williamsburg	78	20	47.4	2.95	3.2
Williamstown	76	23	44.6	3.32	1.0
Louisiana.					
Abbeville	85	31	63.9	0.62	
Alexandria	87	29	61.0	6.01	
Amite	87	29	61.6	2.34	
Baton Rouge	85	29	64.5	1.83	
Burnside	86	27	63.6	0.89	
Calhoun	.....	.....	.....	8.91	
Cameron	79	37	63.0	1.12	
Cheneyville	83	27	60.5	3.27	
Clinton	83[e]	28[e]	63.0[e]	3.72	
Collinston	89	31	58.0	7.30	
Covington	84	25	60.5	1.48	
Crowley	82	32	63.0	2.46	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
***Louisiana*—Cont'd.**					
Donaldsonville	87	35	66.8	0.40	
Farmerville	87	32	57.7	9.35	
Franklin	87	31	64.8	0.65	
Grand Coteau	86	29	63.6	3.03	
Houma	84	28	63.8	2.21	
Jennings	85	31	62.6	0.87	
Lafayette	89	28	64.0	0.87	
Lake Charles	87	31	61.0	3.50	
Lakeside	85	33	63.6	0.99	
Lawrence	85	41	65.2	0.63	
Libertyhill	87	25	58.0	7.67	
Logansport				3.09	
Melville	86	26	61.9	3.65	
Monroe	88	33	61.0	4.54	
Morgan City				0.24	
New Iberia	86	35	65.7	0.60	
Opelousas				2.20	
Oxford				2.83	
Pearl River				1.20	
Plain Dealing	85	26	56.1	3.52	
Rayne	84	30	63.7	2.07	
Reserve	85	33	64.0	1.20	
Robeline	88	27	55.6	2.75	
Ruston	85	30	58.2	9.25	
Schriever	90	27	64.0	1.17	
Simmesport				3.18	
Southern University				1.05	
Sugar Experiment Station	84	34	64.5	1.10	
Sugartown	81	32	60.6	6.55	
Maine.					
Bar Harbor	60	15	36.8	4.10	7.0
Cornish	57	10	34.5	2.57	15.5
Danforth				5.56	14.5
Debsconeag	50	12	32.6	2.87	2.0
Fairfield	57	12	34.2	2.63	9.0
Farmington	62	9	34.2	2.94	11.0
Gardiner	60	11	37.1	3.95	14.5
Greenville	47	−1	28.8	1.85	14.0
Houlton	48	4	35.4	1.20	12.0
Lewiston	62	18	36.8	3.26	13.8
Madison	50	10	32.2	3.02	8.0
Mayfield	46	10	30.8	3.61	18.0
Millinocket	52	0	32.8	4.21	22.6
North Bridgton	62	15	35.6	3.36	15.0
Oquossoc	60	8	32.4	1.43	22.0
Orono	56	5	34.1	3.52	20.5
Patten	51	4	32.0	1.88	18.0
Rumford Falls	60	13	35.1	2.68	13.4
The Forks				2.61	20.6
Vanburen	46	0	28.9	2.10	13.0
Winslow	57	11	33.6	2.96	12.0
Maryland.					
Annapolis	65	29	48.1	2.95	T.
Bachmans Valley	68	23	43.2	1.72	6.0
Cambridge	75	25	47.2	1.96	1.5
Cheltenham	74	26	45.7	2.27	T.
Chestertown	66	30	45.8	2.41	1.0
Chewsville	69	22	43.0	0.73	0.8
Clearspring	66	25	43.9	0.79	0.8
Coleman	67	29	46.8	2.25	1.0
Collegepark	72	20	45.0	1.55	T.
Cumberland	75	22	46.0	1.50	
Darlington	64	24	44.5	2.84	6.0
Deerpark	73	15	40.1	1.70	7.0
Easton	72	25	46.6	1.96	T.
Fallston	64	26	44.4	2.14	1.0
Frederick	67	28	45.1	1.14	T.
Frostburg				1.21	2.5
Grantsville	72	20	40.4	1.72	5.5
Great Falls	72	24	45.4	1.84	T.
Greenspring Furnace	69	25	44.6	0.71	T.
Harney				0.85	T.
Jewell	74	28	47.0	2.44	T.
Johns Hopkins Hospital				1.77	T.
Keedysville	67	24	45.1	0.95	T.
Lake Montebello	64	26	45.3	1.93	T.
Laurel	69	20	44.6	1.98	T.
Monrovia	66	28	45.0	1.95	T.
Mount St. Marys College	66	27	44.2	1.01	2.0
Oakland	76	15	40.4	1.50	4.0
Pocomoke City	72	26	47.8	1.56	
Porto Bello	75	25	48.3	1.73	T.
Princess Anne	74	21	46.1	1.54	
Salisbury	74	19	46.8	1.67	
Solomons	73	32	47.8	1.72	T.
Sudlersville	67	23	45.0	2.19	1.0
Takoma Park	73	27	45.7	1.68	T.
Taneytown	67	20	43.1	0.88	0.1
Van Bibber	67	29	45.4	2.01	T.
Westernport	78	24	45.0	0.65	0.5
Woodstock	69	27	46.2	1.85	T.
Massachusetts.					
Amherst	62	18	38.6	1.98	4.0
Bedford	63	16	38.6	2.02	1.0
Bluehill (summit)	65	18	38.6	2.56	5.0
Cambridge	67	19	40.8	3.47	
Chestnuthill	67	19	40.8	3.37	
Concord	66	14	37.8	2.67	2.5
***Massachusetts*—Cont'd.**					
Fallriver	63	21	41.2	2.47	1.0
Fitchburg	60	21	38.6	1.98	10.5
Framingham	64	15	38.8	2.50	3.5
Groton	59	15	35.8	2.97	11.0
Hyannis				1.78	0.3
Jefferson				2.04	10.8
Lawrence	66	17	38.9	2.68	1.5
Leominster				2.30	10.2
Lowell	63	18	39.8	3.08	
Middleboro	67	16	39.4	2.33	0.5
Monson	63	19	37.6	2.19	6.5
New Bedford	64	22	42.6	3.16	T.
Plymouth	64	19	40.6	3.45	
Princeton				2.28	11.5
Provincetown	68	25	43.3	2.78	T.
Salem				2.85	1.5
Somerset	68	16	40.7	2.79	1.0
Sterling				2.01	9.5
Taunton	64	16	39.8	2.38	T.
Webster				2.12	5.0
Westboro	66	15	40.6	2.96	3.5
Weston	67	15	38.2	2.50	2.6
Williamstown	59	16	36.0	2.45	7.0
Winchendon				1.93	9.0
Worcester	62	20	39.2	1.86	6.6
Michigan.					
Adrian	68	16	38.2	2.80	
Agricultural College	59	8	37.0	2.66	0.8
Allegan	68[f]	21[g]	39.2[g]	2.80	T.
Alma	57	17	36.8	3.53	T.
Ann Arbor	57	19	38.7	1.61	T.
Arbela	57	16	37.4	3.71	3.0
Ball Mountain	60	19	38.0	2.11	2.0
Baraga					9.0
Battlecreek	61	19	39.3	3.67	T.
Bay City	55	19	37.6	2.45	T.
Benzonia	52[d]	24[e]	36.1[d]	2.87	T.
Berlin	55	19	37.6	2.19	3.6
Big Rapids	60	19	36.5	3.84	T.
Birchwood	70	18	42.9	5.20	
Blaney	50	12	32.2	3.89	4.9
Bloomingdale	69	21	40.4	3.50	T.
Calumet	50	17	33.4	4.21	27.0
Cassopolis	67	22	37.7	4.40	1.0
Charlevoix	53	25	37.9	3.08	T.
Charlotte	56	11	34.6	1.80	
Chatham	47	3	31.4	2.64	17.5
Cheboygan	58	19	38.8	4.38	T.
Clinton	60	15	38.1	2.53	T.
Coldwater	68	19	40.8	2.99	1.0
Concord	59	20	38.7	1.80	T.
Deer Park	51	17	34.6	2.18	11.0
Detour	51	21	36.1	5.15	6.1
Dundee	68	18	38.6	2.80	T.
Eagle Harbor	50	23	36.2	5.08	41.8
East Tawas	58	17	36.3	3.76	0.2
Eloise	60	18	38.0	2.01	2.0
Fennville	65[e]	22[e]	39.5[e]	2.06	
Flint	57	13	36.7	3.22	2.5
Frankfort	58	27	39.3	3.98	T.
Grand Marais	51[e]	19[e]	36.4[e]	4.17	7.0
Grape	67	19	38.0	3.10	T.
Grasslake	60	18	38.1	2.51	1.0
Grayling	58	15	35.0	3.30	0.5
Hagar	62	15	37.0	4.25	T.
Harbor Beach	55	21	39.4		
Harrison	54	17	34.8	4.50	
Harrisville	54	17	36.8	4.01	6.0
Hayes	55	15	37.6	2.71	3.0
Highland	59	14		2.50	2.0
Hillsdale	61	20	37.2	2.92	T.
Holland	58[g]	23[g]	38.4[g]	2.95	T.
Howell	57[e]	18[e]	36.6[e]	2.35	0.8
Humboldt	50	−1	29.3	3.95	27.0
Iron Mountain	54	10	33.0	3.59	13.0
Iron River	60	2	29.4	3.90	17.0
Ironwood	56	11	30.9	3.56	13.8
Ishpeming				5.93	59.3
Isle Royal	47	22	34.9	2.20	4.0
Ivan	58	14	34.6	2.32	0.5
Jackson	60	21	39.0	2.35	0.5
Jeddo	54	17	38.0	1.93	1.5
Kalamazoo	64	21	38.4	2.49	T.
Lansing	60	20	38.2	2.66	0.5
Ludington	60[d]	25[d]	39.5[d]	5.07	2.0
Mackinac Island	49	20	35.0	2.70	T.
Mackinaw	63	17	37.6	3.52	T.
Mancelona	60	20	35.7	2.16	
Manistee	60	25	38.9		
Maple Ridge	50	5	31.4	3.56	16.0
Marlboro	62	20	37.2	3.51	T.
Menominee	52	17	36.3	3.31	T.
Mio	57	15	34.3	3.52	2.5
Montague	60	24	38.6	3.25	
Mount Clemens	64	17	38.1	2.10	1.5
Muskegon	60	21	38.3	3.40	T.
Newberry				2.20	7.0
Old Mission	53	25	37.0	3.49	1.0
***Michigan*—Cont'd.**					
Olivet	59	20	37.8	2.72	0.1
Petoskey	56	23	37.4	5.63	0.5
Plymouth	58	16	38.0	1.30	0.5
Pontiac	55[g]	18[a]	37.6[d]	1.57	
Port Austin	55	21	39.7		
Reed City	56	19	36.5	3.12	
Saginaw (W. S.)	57	19	37.4	2.62	0.5
St. James	49[e]	18[e]	36.0[e]	3.75	T.
St. Johns	60	16	36.6	2.62	
St. Joseph	64	22	40.6	4.27	4.0
Saranac	61	14	38.1	1.86	T.
Slocum	59	21	37.6	3.53	
Somerset	60[e]	16[e]	36.3[e]	2.57	1.0
South Haven	65	20	39.0	3.02	6.5
Stanton	58	15	35.9	1.95	1.9
Thomaston	56[d]	12[d]	31.5[d]		14.0
Thornville	55	22	38.9	3.21	3.5
Traverse City	54	24	37.8	3.59	2.0
Vassar	55	15	38.6	3.50	3.0
Wasepi	64	20	38.0	3.48	1.0
Webberville	58	16	37.4	3.02	1.0
West Branch	48[e]	12[e]	32.8[e]		T.
Wetmore	52	6	32.5	3.30	13.0
Whitefish Point	53	20	35.8	4.07	7.9
Woodlawn	58	6	33.1	4.86	8.5
Ypsilanti	61	18	38.2	2.46	0.5
Minnesota.					
Albert Lea	64	13	32.9	1.71	0.1
Alexandria	59	−5	28.2	1.29	5.0
Amboy	68	11	34.4	1.99	2.0
Angus	56	−12	26.9	0.37	2.0
Bagley	54	−16	26.6	1.79	16.0
Beardsley	59	−13	25.4	0.64	1.9
Beaulieu	59	−12	28.0	1.28	10.5
Bird Island	64	8	31.8	1.48	4.0
Caledonia	64	7	33.9	1.96	6.5
Collegeville	61	6	31.2	1.23	5.8
Crookston	56	−9	27.1	2.18	18.0
Detroit	55	−16	26.6	1.92	9.5
Faribault	55	11	34.0	0.98	0.5
Farmington	66	9	32.4	2.68	5.2
Fergus Falls	58	−5	29.3	2.26	19.1
Fort Ripley	60	−5	29.0	1.34	11.0
Glencoe	66	10	32.4	1.74	2.0
Grand Meadow	69	9	32.4	2.68	4.5
Hallock	55	−11	27.2	2.15	18.0
Hinckley	62	7	30.8	2.89	2.0
Leech	54	5	25.9		23.6
Little Falls	60	0	30.4	0.70	7.0
Long Prairie	56	−8	28.2	1.15	9.2
Luverne	62	8	31.4	0.87	4.0
Lynd	64	4	29.8	0.70	3.5
Mankato				2.59	
Milaca	64	4	29.3	1.58	15.0
Milan	59	0	29.4	0.99	6.2
Minneapolis *1	65	9	33.6	2.40	2.5
Montevideo	66	5	31.5	1.08	4.8
Mora	63	7	30.4	2.63	10.0
Morris	60	−2	28.8	0.82	6.0
Mount Iron	56	−10	27.5		9.0
New London	57	2	30.0	0.70	4.0
New Richland	66	12	34.5	2.13	1.0
New Ulm	71	4	37.0	0.69	3.0
Park Rapids	58	−9	29.0	3.25	21.1
Pine River	58	9	29.6	3.20	17.0
Pipestone	59	4	30.2	1.30	2.0
Pokegama Falls	55	8	29.2	2.73	7.7
Redwing				2.54	
Redwood Falls	66	8	32.6		
Reeds				2.22	5.1
Rolling Green	60	12	32.6	1.97	4.0
St. Charles	67	9	32.4	2.40	5.5
St. Cloud	65	3	30.7	1.15	5.5
St. Peter	60	1	24.5		
Sandy Lake Dam	53	10	30.8	1.55	11.7
Shakopee	66	10	33.8	2.80	0.5
Tonka				2.15	
Two Harbors	55	12	33.4	4.15	
Wabasha	67	9	35.4	2.38	3.8
Wadena	60	−11	28.4	1.95	14.5
Winnebago	65	1	32.6	1.71	2.0
Winnibegoshish	54	1	30.8	3.49	20.8
Winona	65	15	33.7	1.13	5.5
Worthington	60	2	30.3	T.	
Zumbrota	66	12	33.1	1.49	
Mississippi.					
Aberdeen	89	22	55.6	3.11	
Agricultural College	84	30	55.6		
Austin	76	22	49.8	19.78	
Batesville	85	22	52.2	9.93	
Bay St. Louis	82	37	63.8	1.18	
Bellefontaine	80	21	54.2	3.20	
Biloxi	81	34	64.7	0.83	
Booneville	76	24	51.7	4.42	
Canton	85	28	58.0	2.86	
Columbia				0.80	
Columbus	86	22	55.4	2.54	
Corinth	76	25	50.2	5.21	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Crystal Springs	83	29	58.8	1.41	
Duck Hill	84	20	56.1	4.09	
Edwards	82	30	59.8	2.80	
Enterprise	......	......	......	1.75	
Fayette	83	28	56.8	2.10	
Fayette (near)	......	......	......	1.33	
Greenville	82	31	54.4	8.76	
Greenwood	85	27	54.4	7.02	
Hattiesburg	86	27	58.4	1.96	
Hazlehurst	84	28	59.0	1.50	
Hernando	84	20	50.4	9.08	
Holly Bluff	......	......	......	5.60	
Holly Springs	78	21	50.4	8.63	
Indianola	80	28	53.5	10.70	
Jackson	85	31	57.1	2.45	
Kosciusko	88	24	56.2	2.82	
Lake	86	25	56.3	1.70	
Lake Como	87	31	58.8	3.50	
Laurel	87[d]	28[d]	59.2[d]	1.00	
Leakesville	87	29	62.4	1.29	
Louisville	84	25	57.8	1.99	
McNeill	84	27	60.6	1.19	
Macon	86	23	55.6	1.84	
Magee	89	29	59.0	2.00	
Magnolia	84	25	61.6	1.66	
Merrill	......	......	......	1.36	
Natchez	84	30	59.0	2.27	
Okolona	83	24	52.6	4.40	
Pearlington	84	28	62.6	0.93	
Pecan	84	29	62.0	1.44	
Pittsboro	79	20	52.0	3.35	
Pontotoc	77	22	51.6	3.40	
Porterville	85	23	55.8	2.34	
Port Gibson	84	26	56.3	1.57	
Quitman	86	26	59.0	0.58	
Ripley	82	18	52.2	7.80	
Shoccoe	83[d]	28[d]	59.2[d]	2.56	
Shubuta	......	......	......	0.78	
Stonington	......	......	......	1.88	
Suffolk	83	26	61.0	1.79	
Swan Lake	......	......	......	11.90	
Tchula	85	22	57.8	5.52	
Tupelo	81	21	52.8	3.59	
University	84	21	53.4	9.29	
Utica	85	29	60.6	......	
Walnutgrove	83[e]	31[e]	57.4[e]	1.63	
Watervalley	83	21	53.0	6.45	
Waynesboro	85	28	58.2	0.70	
Woodville	81	29	60.7	3.52	
Yazoo City	84	31	56.3	3.30	
Missouri.					
Albany	......	......	......	2.79	7.0
Appleton City	79	11	43.2	2.68	4.0
Arthur	80	11	44.0	2.78	3.5
Avalon	77	7	39.2	1.50	13.0
Belle	79	11	42.9	3.85	6.5
Bethany	74	−3	37.4	3.20	5.0
Bolivar	74	16	42.7	3.09	T.
Boonville	......	......	......	......	
Brunswick	77	10	38.2	2.49	6.5
Caruthersville	80	18	48.4	10.07	2.0
Clinton	78	17	42.2	3.38	5.9
Conception	76	14	38.2	2.13	9.5
Dean	78	15	46.9	1.13	1.5
De Soto	75	19	44.0	4.36	3.5
Doniphan	75	16	44.9	6.70	1.0
Eldorado Springs	79	14	42.4	1.72	6.0
Fairport	......	......	......	2.69	8.5
Fayette	77	16	41.8	2.60	6.5
Fulton	78	12	42.6	2.58	T.
Gallatin	......	......	......	2.63	7.5
Gano	77	12	44.0	3.62	4.5
Glasgow	......	......	......	2.44	6.5
Goodland	72	19	42.6	3.80	1.0
Gorin	......	......	......	1.92	3.0
Grant City	76	9	38.9	2.23	8.0
Harrisonville	75	14	39.4	1.81	5.5
Hazlehurst	......	......	......	3.20	11.5
Hermann	......	......	......	3.13	0.5
Houston	73	12	43.4	3.60	1.0
Huntsville	......	......	......	4.45	
Ironton	76	10	41.9	5.59	4.0
Jackson	78	18	46.5	7.66	5.0
Jefferson City	76	13	39.7	2.50	9.6
Joplin	78	23	48.2	2.77	......
Kidder	74	11	38.1	2.74	8.0
Koshkonong	76	18	46.6	3.08	T.
Lamar	78	15	45.1	2.28	3.0
Lamonte	......	......	......	2.81	5.5
Lebanon	75	21	42.8	3.32	
Lexington	77	15	40.8	3.45	10.0
Liberty	69	14	40.2	3.10	9.2
Lockwood	70[e]	20[e]	43.0[e]	2.16	3.0
Louisiana	75	18	41.2	2.92	2.0
Macon	77	14	40.5	2.39	3.0
Marblehill	78	18	45.6	6.33	4.0
Marshall	77	9	38.8	4.11	10.0
Maryville	74	11	37.0	2.04	6.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mexico	76	11	39.2	2.42	4.5
Monroe	75	15	39.8	2.04	3.2
Mount Vernon	77	15	44.5	2.61	......
Mountain Grove	71	19	44.0	2.56	0.5
Neosho	77	13	45.0	1.61	3.5
New Madrid	......	......	......	9.71	2.0
New Palestine	76	17	42.8	2.07	7.8
Oakfield	75	16	43.6	4.40	4.2
Olden	75	14	45.3	3.41	T.
Oregon	74	15	39.0	1.78	5.5
Osceola	......	......	......	4.93	
Princeton	69	11	40.1	1.30	9.0
Rockport	......	......	......	1.84	2.0
Rolla	......	......	......	3.95	5.5
St. Charles	77	18	42.6	3.57	2.0
St. Joseph	......	......	......	2.06	7.5
Sarcoxie	......	......	......	2.36	1.0
Sedalia	76	16	41.5	2.94	7.5
Sikeston	76	19	45.8	6.37	4.0
Steffenville	78	16	40.4	2.25	2.0
Sublett	74	10	39.0	3.10	7.0
Trenton	71	11	38.4	3.32	10.0
Unionville	74	8	36.6	3.11	12.0
Versailles	76	14	40.7	2.90	5.5
Warrensburg	78	12	42.0	2.30	9.0
Warrenton	75	19	40.2	3.16	2.5
Warsaw	77	8	42.5	3.37	13.0
Wheatland	......	......	......	2.75	3.0
Willowsprings	65	12	41.2	3.63	1.0
Windsor	88	10	43.6	1.98	9.3
Montana.					
Absarookee	......	......	......	0.16	2.8
Adell	60	−2	33.1	2.78	24.0
Anaconda	61	0	30.8	1.33	0.9
Augusta	61	−13	28.9	0.60	6.0
Babb	53[b]	−4[b]	26.6[b]	1.13	9.0
Bear Creek	48	−2	25.9	7.07	8.0
Billings	69	7	36.0	0.67	T.
Bozeman	61	−3	28.0	1.70	14.0
Boulder	69	−9	28.2	0.75	1.6
Broadview	64	0	32.2	0.74	6.1
Butte	56	0	30.6	0.80	2.5
Canyon Ferry	61	−4	29.2	0.50	3.0
Chester	56	−13	23.0	0.75	7.5
Chinook	62[c]	−7[c]	31.4[c]	0.26	T.
Choteau	60	−5	31.4	0.70	T.
Clear Creek	64	−3	29.0	0.98	6.0
Columbia Falls	58	7	31.0	2.68	2.2
Copper	......	......	......	1.79	9.8
Crow Agency	65	−4	31.4	1.20	6.0
Culbertson	63	−8	24.2	1.21	2.5
Dayton	57	9	31.0	2.38	2.8
Decker	60	−6	23.2	T.	T.
Deer Lodge	58[e]	−2	29.7[e]	0.80	5.5
Dillon	70	−4	32.2	1.16	6.4
Ekalaka	64	−4	29.7	0.45	T.
Erickson	......	......	......	0.33	0.6
Evans	58[f]	−5[f]	28.0[f]	5.70	60.0
Fallon	66	−3	29.1	0.96	
Forsyth	67	−3	32.4	1.12	3.5
Fort Benton	60	−2	31.2	0.82	3.0
Fort Harrison	70	−5	29.8	......	
Fortine	52	4	29.5	2.26	6.5
Glasgow	64	−6	26.3	0.25	0.5
Glendive	68	−1	29.1	0.43	4.0
Gold Butte	......	......	......	1.29	8.0
Graham	66	2	33.8	0.96	T.
Grayling	53[e]	−19[e]	21.4[e]	0.36	1.0
Greatfalls	60	2	31.9	1.97	14.6
Homepark	......	......	......	0.40	3.5
Huntley	72	1	34.6	0.80	......
Jordan	65	−6	28.4	0.30	3.0
Lame Deer	66	0	33.8	0.20	2.0
Lewistown	62[c]	−4	31.1[d]	0.89	6.1
Livingston	63	4	33.8	1.04	1.5
Lodge Grass	68	−7	31.6	0.53	2.5
Marysville	53	−5	23.4	3.74	18.0
Missoula	58	7	31.8	3.45	T.
Mullets Ranch	......	......	......	0.76	4.5
Nye	......	......	......	0.54	1.5
Ovando	53[d]	0[d]	29.2[e]	3.34	T.
Philipsburg	59	−3	29.0	1.05	2.0
Plains	56	10	32.6	2.39	
Polson	53	13	34.1	1.77	1.5
Poplar	65	−4	27.1	1.27	6.0
Raymond	......	......	......	2.32	12.9
Redlodge	60	−5	30.2	0.24	3.3
Renovo	63	1	32.8	0.31	T.
Ridgelawn	62	−5	28.0	1.00	5.5
St. Peter	59	1	31.4	1.27	13.0
Saltese	......	......	......	8.40	3.0
Springbrook	65	−5	28.6	1.78	12.2
Steele	65	−2	32.7	1.25	6.0
Tokna	65	−3	28.2	1.17	5.0
Toston	61	−9	28.4	0.65	1.2
Troy	56	2	32.6	4.13	1.0
Upper Lake	......	......	......	3.76	
Utica	63	−2	33.4	0.42	0.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Warrick	54	−7	28.0	1.03	2.9
Wolf Creek	61	−4	29.9	1.83	4.7
Nebraska.					
Agate	66	−7	32.0	0.26	T.
Ainsworth	65	7	34.3	0.71	0.8
Albion	68	5	35.7[d]	0.43	T.
Alliance	64	3	35.4	0.95	1.0
Alma	75	7	38.5	0.57	
Arapaho	......	......	......	0.75	
Arcadia	......	......	......	1.13	
Ashland	70	16	38.6	0.40	1.9
Ashton	......	......	......	0.82	T.
Atkinson	65	8	33.4	0.29	
Auburn	74	14	38.8	0.72	1.8
Aurora	71	10	38.2	0.00	
Beatrice	73	12	39.2	0.48	2.0
Beaver	72	11	39.4	0.80	T.
Bellevue	70	15	38.6	0.72	3.5
Blair	69	15	37.2	0.50	2.0
Bloomfield	66	7	34.0	0.18	......
Bluehill	......	......	......	0.00	
Bradshaw	......	......	......	0.10	T.
Bridgeport	78	3	35.8	0.55	T.
Broken Bow	69	8	36.2	1.60	......
Burchard	......	......	......	T.	T.
Burwell	......	......	......	1.35	......
Callaway	72	13	38.4	1.10	T.
Central City	......	......	......	0.57	......
Chester	......	......	......	0.60	6.0
Columbus	67	9	35.5	0.48	T.
Crete	70	16	38.6	0.56	1.2
Culbertson	......	......	......	0.48	4.8
David City	67	15	37.3	0.61	T.
Dawson	75	16	39.8	0.95	......
Dubois	......	......	......	0.71	1.0
Dunning	......	......	......	0.38	1.2
Ellis	......	......	......	0.30	1.5
Endicott	......	......	......	0.58	2.0
Ericson	......	......	......	0.47	......
Ewing	......	......	......	0.91	
Fairbury	73	9	39.4	0.46	3.1
Fairmont	70	10	36.3	0.07	
Fort Robinson	70	−1	33.4	0.32	2.0
Franklin	74	11	40.0	0.10	T.
Fremont	68	15	36.5	0.43	1.0
Fullerton	......	......	......	0.63	1.0
Geneva	71	11	38.6	T.	T.
Genoa (near)	67	5	36.4	0.49	T.
Gosper	......	......	......	0.88	
Gothenburg	67	10	37.4	1.25	
Grand Island	70	14	38.0	0.28	T.
Grant	69	2	35.0	0.43	4.0
Greely	......	......	......	0.62	
Guide Rock	......	......	......	0.05	T.
Haigler	......	......	......	0.05	0.5
Halsey	68	5	34.6	1.11	1.5
Hartington	65	6	33.6	0.82	
Harvard	67	8	35.8	0.05	T.
Hastings [a1]	69	15	38.0	0.15	T.
Hayes Center	68	10	35.8	0.70	......
Hay Springs	70	−2	33.9	0.41	1.0
Hebron	72	9	38.2	0.34	2.0
Hendley	......	......	......	0.70	
Hickman	......	......	......	0.20	2.0
Holbrook	65	10	35.8	0.95	
Holdrege	70	11	38.6	1.04	T.
Hooper	67	16	36.0	0.41	2.2
Imperial	70	6	36.6	0.78	4.0
Kennedy	67	2	34.4	0.95	5.0
Kirkwood	66	4	35.4	1.00	
Leavitt	70	16	36.7	0.23	0.5
Lexington	67	0	35.4	0.82	1.0
Loup	68	7	35.9	1.26	
Lynch	72	4	38.2	0.70	
McCook	......	......	......	0.75	
McCool	......	......	......	0.06	
Madison	68	10	36.8	0.35	T.
Marquette	......	......	......	0.36	T.
Mason	......	......	......	1.30	......
Merriman	......	......	......	0.05	0.5
Minden	72	10	37.2	0.62	0.2
Monroe	......	......	......	0.57	T.
Nebraska City	72	15	38.4	0.70	2.0
Nemaha	......	......	......	0.15	1.5
Norfolk	64	8	34.6	0.72	0.5
North Loup	63	8	35.4	1.09	T.
Oakdale	62	6	34.0	0.87	T.
Oakland	67	14	35.4	0.11	
Odell	......	......	......	0.50	1.0
Ord	......	......	......	1.37	
Palmer	......	......	......	T.	
Palmyra [a1]	74	16	38.6	0.45	
Pawnee City	73	14	38.7	0.46	0.8
Plymouth	72	10	38.6	0.23	
Purdum	67	5	34.6	1.78	5.5
Ravenna	70	8	36.4	0.85	T.
Redcloud	75	8	41.9	0.50	
Rulo	......	......	......	2.20	5.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Libory				0.43	
St. Paul	72	9	37.9	0.55	
Santee	67	9	36.8	1.19	0.1
Schuyler				0.25	0.5
Seward	72	15	38.4	0.15	T.
Smithfield				0.96	
Springview	62	5	33.8	0.25	T.
Stanton	67	8	34.5	0.49	1.0
Strang				T.	T.
Stratton				1.25	
Stromsburg				0.00	
Superior	77	9	40.1	0.05	0.5
Syracuse				0.73	1.8
Tablerock				0.52	0.8
Tecumseh	75	12	41.7	0.50	T.
Tekamah	67	15	36.3	0.49	3.0
Turlington	71	15	38.0	0.83	5.5
University Farm	70	15	38.6	0.32	1.0
Wahoo				0.50	5.0
Wakefield	65	12	35.0	0.58	1.6
Watertown				1.36	3.0
Wauneta				0.70	
Weeping Water				0.49	4.5
Westpoint	68	11	35.8	0.32	2.0
Wilber				0.15	2.0
Wilsonville				0.35	
Winnebago	69	8	34.0	0.61	2.0
Wisner				1.01	2.2
Wymore				0.35	2.5
York	67	9	36.9	0.22	T.
Nevada.					
Amos	67	−5	34.9	0.63	3.6
Austin	66	4	33.4	1.41	45.7
Battle Mountain	71	18	43.3	0.50	5.0
Beowawe				0.30	3.0
Carlin	65	−3	23.4	0.40	4.0
Carson City	79	10	38.0	1.14	3.4
Carson Dam	73	9	38.9	0.34	2.8
Dyer	75	−20	28.0	1.35	13.5
Elko *[1]	74	−5	31.6	0.23	2.2
Ely	78	−3	34.4	1.02	3.2
Eureka	67	−6	33.2	1.24	17.5
Fallon	81	−1	37.8	0.44	5.5
Gardnerville	75	9	35.8	1.10	1.0
Geyser	70	−22	31.0	1.28	10.5
Halleck *[1]	63	−13	31.8	0.45	4.5
Hazen	72	1	37.4	0.44	6.0
Humboldt	65	18	41.9	0.90	9.0
Leetville	76	0	38.4	0.37	5.2
Lewers Ranch	79	11	39.6	3.11	3.0
Logan	83	22	50.8	0.58	
Lovelocks	75	3	36.3	0.22	2.2
Mill City *[1]	66	10	41.2		
Palmetto	73	−15	30.6	5.60	56.0
Paradise Valley				0.21	
Pioche	72	3	35.8	1.67	13.0
Potts	68	−16	29.1	0.15	3.5
San Jacinto	67	−19	29.6	0.62	5.4
Squaw Valley	70	−12	30.9	0.49	8.5
Stillwater	76	−4	31.5	0.39	3.0
Tecoma	65	−4	30.2	1.32	13.0
Wabuska	71	0	35.3	0.10	1.0
Wadsworth	78	4	42.7	0.20	2.5
Wood				1.14	9.1
New Hampshire.					
Alstead	53	11	33.6	1.82	21.0
Bartlett				2.67	18.0
Bethlehem	55	4	30.6	1.80	10.5
Bretton Woods				1.60	12.0
Brookline	60	16	39.2	2.47	10.1
Durham	61	18	35.8	3.11	5.2
Franklin Falls	58	15	35.8	2.65	7.3
Grafton					12.0
Groveton				2.01	20.5
Hanover	56	7	33.8	1.93	8.7
Keene	59	11	35.6	2.03	6.5
Nashua	59	19	37.2	3.69	11.5
Newton	64	16	37.4	3.56	2.0
North Woodstock				2.71	
Plymouth	54	14	35.2	1.94	3.3
New Jersey.					
Asbury Park	64	24	45.1	1.26	T.
Bayonne	68	26	43.8	1.27	1.0
Belvidere	65	17	41.6	1.98	8.8
Bergen Point	68	26	44.4	1.34	1.0
Beverly	67	23	43.8	1.56	0.4
Bridgeton	66	22	45.6	1.89	T.
Browns Mills	67[e]	18[e]	43.6[e]	1.56	T.
Canton				1.56	0.5
Cape May C. H.	64	22	45.8	1.71	T.
Charlotteburg	60	19	41.4	1.53	7.0
Clayton	68	23	44.6	1.65	T.
College Farm	68	23	43.0	1.50	2.5
Dover	59	23	39.8	1.51	6.0
Elizabeth	66	22	44.7	1.28	0.4
Englewood	64	24	43.2	1.71	2.0
Flemington	62	24	43.0	1.30	4.0
Friesburg	66	22	44.8	1.90	2.5

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hightstown	68	23	43.0	1.25	T.
Imlaystown	68	23	43.8	1.30	T.
Indian Mills	69	19	44.6	1.99	
Jersey City	62	27	44.6	1.40	0.5
Lakewood	67	23	44.8	1.30	
Lambertville	65	24	43.4	1.65	3.0
Layton	60	8	38.6	2.39	10.0
Moorestown	68	22	44.2	1.70	2.2
Newark	66	26	44.2	1.37	4.2
New Brunswick	65	23	43.0	1.62	2.0
Newton	59	17	40.2	2.10	8.5
Oceanic	68	28	44.8	1.10	T.
Paterson	67	27	44.8	1.31	4.0
Phillipsburg	63	23	41.8	1.44	6.0
Plainfield	67	23	42.5	1.26	3.8
Pleasantville				1.91	
Rancocas				1.64	0.2
Somerville	67	22	42.9	1.65	3.5
South Orange	64	25	42.6	1.06	3.0
Sussex	60	20	40.4	1.37	6.0
Toms River	70	20	43.8	1.69	T.
Trenton	67	25	45.8	1.57	T.
Tuckerton	67	21	44.2	2.09	T.
Vineland	67	20	44.3	1.65	T.
Woodbine	68	17	44.7	1.90	
New Mexico.					
Alamagordo	79	12	48.0	2.22	5.0
Albert	80	8	43.5	0.70	4.0
Albuquerque	72[e]	16[e]	47.8[e]		
Alto				2.44	17.5
Aragon	72	5	44.8	1.82	8.0
Artesia	83	4	45.8	2.82	16.0
Bellranch	84	0	42.8	1.00	4.0
Bloomfield	68			0.65	1.2
Cambray				1.38	0.7
Carlsbad	84	2	46.4	3.43	12.0
Chama	64	−1	37.2	0.96	10.9
Cimarron	72	−6	36.6	0.66	7.5
Cliff	82	16	48.0	1.01	
Cloudcroft	62	−3	33.6	3.55	23.0
Datil	76	−3	41.2		14.0
Deming	78	17	48.0	1.34	4.0
Dulce	66	7	37.2	0.90	1.5
Eagle Rock Ranch	66	−1	36.1	0.85	8.0
Elizabethtown	57	−4	30.9	0.44	3.0
Elk	79	3[c]	42.9[d]	2.29	16.0
El Vado	65	12	36.2	0.93	4.0
Engle	78[i]	2[i]	40.4[i]		4.0
Estancia	76	3	38.1	1.33	4.0
Fairview	80[k]	−8[k]	38.8[k]		4.0
Fort Bayard	75	−1	45.8	1.93	14.2
Fort Stanton	74	0	40.0	0.86	8.2
Fort Union	71	6	36.5	1.00	8.0
Fort Wingate	70	4	39.4	1.28	7.3
Fruitland	68	11	40.8	1.18	T.
Gage				0.47	1.0
Glen	82	0	42.5	2.16	16.4
Hope				1.46	12.0
Laguna	69	10	40.7	1.03	1.0
Lagunita	78	2	41.2	1.55	13.0
Lake Valley				1.31	10.2
Las Vegas	74	0	38.1	0.86	6.5
Lordsburg	81	12	51.4	1.31	1.0
Los Alamos				0.81	10.0
Los Lunas	75	12	43.2	0.50	2.0
Luna	62	−2	35.8	1.30	10.5
Magdalena	75	−4	40.6	1.47	9.0
Manuelito				0.87	5.5
Mesilla Park	81	17	49.6	2.03	5.0
Mimbres				0.80	9.0
Mineral Hill				0.80	10.0
Monument	86	−2	48.2	2.73	14.0
Mountain Air	74	−2	39.0	1.49	10.0
Nara Visa	77[e]	2	43.1	2.12	12.0
Orange	82	8	45.3	2.10	4.5
Red River	58	−8	30.9	1.66	20.0
Redrock				0.98	5.6
Rincon	83	12	50.5	0.77	0.5
Rociada	68	−3	35.3	0.97	13.0
Rosedale	70	0	40.6	0.86	9.6
San Marcial	77	15	46.4		
San Rafael	74	8	40.8	0.71	5.4
Socorro	86	12	41.5	0.67	2.8
Springer	79[m]	−10	43.2[e]	0.50	5.0
Strauss				1.45	4.5
Taos	70[n]	2[n]	35.4[n]	0.91	3.0
Tres Piedras	67[l]	−12[l]	29.7[l]		7.5
Tucumcari	81	−1	41.4	1.66	18.0
Valley				0.91	5.5
Vermejo	64	−3	31.6	0.20	2.5
Winsor	67	−2	33.6	1.32	16.5
New York.					
Adams	63	17	36.8	3.78	14.0
Addison	64	16	39.0	1.19	1.4
Amsterdam	53	16	34.8	3.22	11.0
Angelica	63	15	35.8	1.90	8.5
Appleton	68	23	38.8	1.82	
Athens	62	18	39.0	2.20	6.7

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Atlanta	64	10	36.2	2.35	14.0
Atwater				2.15	14.4
Auburn	64	20	37.0	2.19	11.0
Avon	65	12	36.4	2.21	4.5
Baldwinsville	63	20	37.4	2.21	
Bedford	62	20	41.4	1.44	5.9
Berlin	60	12	37.2	2.32	8.0
Blue Mountain Lake				2.82	9.0
Bolivar	66	15	37.6	1.50	2.7
Bouckville	57	6	29.7	2.09	13.0
Brockport	67	18	38.2	2.65	5.0
Cape Vincent	58	18	36.7	2.47	0.2
Carmel	57	18	39.5	1.57	4.2
Carvers Falls	55	12	34.2	2.69	8.0
Chatham	61	17	37.1	1.67	8.0
Chazy	53	7	33.1	3.38	10.3
Coeymans	57	16	37.0	1.68	6.0
Cold Spring Harbor	66	21	42.6	1.70	T.
Cooperstown	55	14	34.0	3.01	14.0
Cortland	58	6	33.9	2.25	9.0
Cutchogue	62	25	43.5	1.65	T.
Dannemora	56	11	31.2	1.71	11.6
Dekalb	60	11	33.1	2.54	6.0
De Ruyter	59	6	34.4	2.61	19.2
Easton				1.02	6.0
Elba	67	18	36.2	2.39	9.0
Elmira	65	17	39.4	1.63	1.0
Faust	54	6	30.4	1.73	16.5
Fayetteville	64	18	36.8	3.25	16.0
Fort Plain	53	15	37.2	3.18	18.0
Franklinville	64	16	36.4	2.22	7.5
Gabriels	54	8	29.4	2.31	19.0
Gansevoort				1.54	9.5
Glens Falls	55	12	35.4	2.87	12.0
Gloversville	59	13	35.1	3.04	15.5
Greenfield	53	12	35.0	1.90	8.5
Greenwich	56	12	35.0	2.37	6.0
Griffin Corners	58	7	33.4	4.81	27.1
Harkness	55	14	33.6	2.76	17.0
Hemlock	62	24	38.7	2.15	7.5
Hunt	65	19	37.6	2.73	13.5
Indian Lake	55	0	31.4	3.05	16.0
Ithaca	66	14	37.2	1.94	9.5
Jamestown	65	22	39.4	2.33	6.0
Jeffersonville	60	7	36.0	1.96	10.1
Keene Valley	57	3	32.8	2.88	20.0
Lake George	56	14	36.3	3.39	11.3
Le Roy	68	20	37.0	2.39	11.4
Liberty	56	7	36.2	2.49	11.0
Littlefalls, City Res.	53	15	34.5	2.28	15.0
Lockport	65	22	37.8	2.61	T.
Lyndonville				2.51	4.6
Lyons	63	19	38.6	3.69	13.5
Middletown	59	21	40.6	1.72	7.0
Mohonk Lake	58	18	37.4	1.83	4.0
Moira	55	13	33.2	2.82	15.0
Mount Hope	63	20	41.7	1.47	5.0
Newark Valley				1.82	11.0
New Lisbon	57	6	32.9	2.50	12.0
North Hammond	59	12	34.3	2.04	T.
North Lake	54	−10	30.0		7.6
Norwich	60	12	36.4	1.93	7.6
Ogdensburg	57	9		2.43	14.2
Oneonta	64	15	38.0	3.04	13.0
Oswegatchie	78	10	29.4	1.30	8.0
Otto	70	17	39.8	2.43	
Oxford	56	12	36.2	1.89	13.7
Oyster Bay	68	25	43.8	1.46	0.5
Palermo				2.62	8.4
Perry City	64	11	35.4	2.43	15.0
Plattsburg	55	14	34.6	2.45	1.3
Port Jervis	61	20	40.7	1.56	8.0
Potsdam	60	10	32.7	3.67	8.0
Romulus	63[d]	22[d]	38.2[d]		
Saranac	57	6	30.6	1.66	18.3
Scarsdale	62	23	41.8	1.00	3.0
Setauket	65	27	42.6	1.87	T.
Shortsville	64	18	37.2	2.14	12.8
Skaneateles				3.44	
Southampton	62	26	43.8	1.84	T.
South Canisteo	62	18	37.2	1.70	8.0
Spier Falls	58	14	35.2	2.83	13.0
Taberg	61	12	36.2	2.23	T.
Volusia	68	23	37.6	2.91	12.0
Wading River	75	19	43.3	0.33	
Wappinger Falls	56	16	38.6	1.67	5.0
Warwick				1.34	7.0
Watertown	71	10	34.4	3.30	5.0
Waverly	62	12	38.0	1.29	5.5
Wedgwood	59	18	36.2	1.78	15.0
West Berne	56	10	35.8	3.01	24.0
Westfield	68	25	39.2	3.63	6.0
Westpoint	59	23	40.0	1.45	1.5
Windham	61	8	35.0	2.36	16.0
Youngstown				1.77	0.5
North Carolina.					
Battleboro				0.70	
Beaufort	74	35	55.6	1.64	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
North Carolina—Cont'd.					
Brevard	72	14	45.6	6.50	3.8
Brewers	76[e]	23	49.0	4.93	1.0
Bryson City	.....	.....	.....	4.55	4.0
Buck Springs	75	10	46.2	7.20	3.0
Caroleen	78	20	50.0	0.85	2.0
Chalybeate Springs	80	.....	.....	0.77	
Chapelhill	78	24	51.4	0.99	T.
Eagletown	79	23	51.4	0.87	T.
Edenton	76	27	51.6	0.90	
Fayetteville	80	23	54.1	0.70	
Goldsboro	79	24	49.2	0.73	
Graham	.....	.....	.....	0.71	2.0
Greensboro	81	23	51.2	0.96	
Greenville	.....	.....	.....	0.68	
Henderson	79	26	50.9	0.84	T.
Hendersonville	73	19	47.4	2.78	3.0
Horse Cove	72	20	48.4	6.11	4.5
Hot Springs	82	22	48.5	4.15	0.5
Kinston	85	22	52.3	0.84	
Lenoir	79	12	50.1	2.75	2.5
Lexington	76	18	49.4	2.61	T.
Lincolnton	80	18	52.5	0.14	1.0
Louisburg	79	23	49.4	0.88	T.
Lumberton	81	24	52.3	1.02	
Marion	77	19	50.4	3.40	3.4
Marshall	80	17	47.4	.....	.....
Moncure	81	20	50.2	0.62	
Monroe	77	16	48.9	0.66	T.
Morganton	77	16	49.4	1.72	1.8
Mountairy	74	17	46.7	3.18	1.0
Mount Holly	.....	.....	.....	0.82	
Murphy	.....	.....	.....	9.27	0.6
Nashville	78	22	50.9	0.81	
Newbern	85	25	53.4	1.29	
Patterson	70	16	45.3	4.72	3.5
Pinehurst	79	27	53.8	0.04	T.
Pink Beds	69	6	42.5	7.86	4.5
Pittsboro	82[b]	25[b]	54.8[b]	.....	.....
Randleman	.....	.....	.....	0.82	
Reidsville	.....	.....	.....	0.53	3.0
Rockingham	80	20	52.2	0.55	
Salem	77	19	49.2	0.39	1.0
Salisbury	79	17	50.6	0.81	1.5
Sapphire	70	11	45.0	1.41	4.0
Saxon	76	18	47.6	0.86	2.5
Scotland Neck	80	25	52.6	0.76	
Selma	75	25	52.4	1.65	
Sloan	82[e]	22[e]	53.6[e]	1.13	
Snowhill	80	22	52.2	0.73	
Southern Pines	80	26	53.8	0.65	
Southport	78	29	46.1	1.40	
Statesville	80	16	49.2	0.80	0.5
Tarboro	81	24	51.8	0.70	
Vade Mecum	76	11	47.0	0.98	2.5
Washington	85	22	53.4	0.68	T.
Waynesville	75	11	45.3	4.04	1.4
Weldon	83	24	50.0	0.92	T.
North Dakota.					
Amenia	63	−12	26.1	1.38	11.5
Beach	64	− 1	27.0	0.62	2.0
Berlin	62	−10	25.0	1.36	7.5
Bottineau	53	− 8	24.7	2.14	.....
Broncho	64[f]	2[f]	26.3[f]	1.14	8.5
Buford	68	− 2	27.0	0.86	5.8
Cando	53	−14	23.4	0.85	12.0
Coalharbor	58	− 2	26.0	1.23	2.2
Dickinson	65	− 1	26.4	0.87	5.5
Donnybrook	60[e]	0[e]	20.5[e]	2.29	20.0
Dunseith	52	−11	23.6	1.45	14.0
Edgeley	53	−14	25.0	1.05	7.0
Edmore	59	−16	25.4	1.82	16.0
Ellendale	65	− 4	29.4	2.41	.....
Fargo	57	− 7	27.2	1.01	.....
Forman	55	0	27.9	0.85	5.0
Fort Berthold	60	−16	25.2	0.65	3.0
Fort Yates	65[d]	− 1[d]	29.0[d]	0.91	1.9
Fullerton	61	− 4	27.3	2.26	13.1
Gladys	59	−10	24.8	2.26	17.0
Glenullin	59	− 2	26.4	1.35	5.0
Grafton	57	−14	26.0	2.15	20.0
Hillsboro	56	−15	26.6	2.04	9.5
Jamestown	62	−11	26.8	1.02	9.2
Kulm	64	− 3	28.2	1.08	6.7
Lakota	54	−14	24.4	3.29	19.0
Lisbon	57	−10	26.2	1.40	6.0
McKinney	57	−16	23.2	1.82	18.0
Manfred	55	−11	24.2	1.83	13.5
Mayville	61	−16	25.2	1.24	.....
Medora	65	− 5[g]	28.8[d]	1.31	7.6
Melville	.....	.....	.....	1.40	14.0
Minot	62	−11	24.7	3.13	19.0
Minto	67[m]	−10[k]	30.2[l]	2.39	.....
Moyersville	58	− 2	25.3	1.20	9.7
Napoleon	61	−10	24.7	1.34	6.5
New Salem	62	2	25.8	0.26	.....
Oakdale	61	0	27.4	0.86	0.8
Oriska	58	−10	26.6	1.80	14.5
Park River	56	−14	25.8	3.94	36.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
North Dakota—Cont'd.					
Pembina	56	−10	25.3	6.49	19.5
Portal	57	−13	23.1	2.08	17.0
Power	58	−14	25.8	1.85	13.0
Pratt	58	−14	23.8	1.48	11.0
Steele	59[e]	− 4[e]	26.6[e]	0.88	2.0
University	58	−14	27.8	1.73	15.6
Valley City	56	−13	28.6	1.37	6.8
Willow City	66	15	23.8	0.80	4.0
Wishek	.....	.....	.....	0.32	.....
Ohio.					
Akron	73	24	40.8	1.84	6.2
Amesville	78	18	43.2	1.79	T.
Atwater	64	26	40.5	2.36	T.
Bangorville	70	21	40.6	2.91	2.0
Bellefontaine	69	18	40.4	2.91	0.7
Benton Ridge	69	19	40.3	2.52	2.0
Bladensburg	73	18	39.5	2.26	1.0
Bowling Green	68	20	39.3	2.53	0.5
Bucyrus	70	20	41.4	4.86	.....
Cadiz	73	24	42.0	1.66	2.9
Cambridge	76	18	43.0	1.35	T.
Camp Dennison	75	17	42.6	3.23	0.5
Canal Dover	71	19	40.6	2.41	1.0
Canton	69	25	40.7	2.39	6.8
Cardington	70	19	40.2	3.08	0.9
Circleville	75	21	41.8	2.24	T.
Clarington	80	21	44.2	1.77	1.5
Clarksville	73	19	43.5	3.00	1.0
Cleveland *b*	69	27	40.4	1.98	1.5
Dayton	71	20	41.9	3.81	0.4
Defiance	68	19	40.0	2.93	0.6
Delaware	73	19	40.2	3.08	0.8
Demos	75	22	42.5	1.34	2.0
Findlay	70	20	40.6	2.15	T.
Frankfort	74	20	42.2	1.85	T.
Fremont	70	22	40.8	2.57	T.
Garrettsville	71	20	39.5	2.84	10.3
Granville	72	20	40.9	2.49	0.5
Gratiot	73	18	41.0	1.71	1.6
Green	80	21	44.0	4.00	2.0
Greenhill	73	19	39.8	2.54	3.2
Greenville	67	19	40.0	2.90	.....
Hedges	65	14	39.0	3.40	T.
Hillhouse	68	21	40.0	3.64	10.0
Hiram	69	24	40.4	2.80	14.0
Hudson	69	20	39.2	2.97	12.0
Ironton	82	23	45.3	2.04	T.
Jacksonburg	74	20	44.4	3.40	.....
Kenton	70	21	38.8	2.72	2.0
Killbuck	72	20	41.3	2.53	1.5
Lancaster	75	22	42.5	1.60	T.
Lima	68	20	42.1[d]	2.84	T.
McConnelsville	78	19	42.9	1.63	2.5
Manara	72	18	41.2	1.77	1.0
Marietta	76	24	45.2	2.22	T.
Marion	73	20	40.8	2.98	T.
Medina	70	20	40.4	2.37	2.0
Milfordton	71	16	38.9	2.58	T.
Milligan	78	17	41.5	1.49	1.0
Millport	72	19	40.0	2.60	2.5
Napoleon	67	19	40.5	2.86	T.
Nellie	73	22	41.4	2.61	5.0
New Alexandria	74	22	41.2	1.58	T.
New Berlin	70	22	40.3	2.19	4.0
New Bremen	65	20	41.3	3.79	T.
New Richmond	75	20	44.1	2.94	1.3
New Waterford	70	21	40.5	2.42	4.0
North Lewisburg	70	18	39.4	3.27	9.2
North Royalton	70[e]	20[e]	39.8[e]	3.16	7.0
Norwalk	73	17	41.2	3.30	0.5
Oberlin	71	17	40.2	2.72	T.
Ohio State University	73	21	41.0	2.44	0.3
Orangeville	68	19	37.1	1.59	2.5
Ottawa	68	20	39.8	3.65	1.0
Pataskala	73	20	41.2	2.14	0.8
Philo	75	22	43.0	0.81	1.2
Plattsburg	69	21	42.2	3.50	1.5
Pomeroy	75	18	41.6	2.51	0.4
Portsmouth	74	23	43.4	4.11	1.0
Pulse	74	17	43.0	2.52	1.0
Rittman	71	20	40.8	2.19	0.5
Rockyridge	69	23	40.5	2.69	T.
Shenandoah	70	20	39.0	2.53	3.6
Sidney	70	19	40.8	2.67	0.2
Somerset	73	23	43.6	1.61	1.5
South Lorain	71	20	40.6	2.57	0.5
Springfield	.....	.....	.....	3.53	0.3
Summerfield	76	17	42.2	1.80	2.5
Thurman	.....	.....	.....	4.03	2.0
Tiffin	69	24	40.4	2.56	1.5
Toledo (St. Johns College)	66	25	39.4	2.79	1.8
Upper Sandusky	70	20	40.4	2.34	T.
Urbana	71	16	39.6	2.78	0.2
Vickery	71	28	39.9	2.52	T.
Warren	74	22	39.8	2.77	9.6
Wauseon	65	18	37.7	3.64	2.1
Waverly	81	17	43.7	1.86	1.2
Waynesville	72	19	42.2	3.37	1.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Ohio—Cont'd.					
Wellington	69	19	41.0	2.49	1.0
Willoughby	.....	.....	.....	2.03	4.0
Wilson	80	15	42.6	2.21	1.5
Wooster	72	23	40.4	2.39	1.8
Zanesville	.....	.....	.....	1.61	1.0
Oklahoma.					
Alva	77	8	44.0	2.66	7.7
Arapaho	79	6	45.4	2.40	4.0
Beaver	76	1	40.0	.....	.....
Blackburn	86	14	45.2	4.76	5.8
Cache	82	13	49.0	2.50	.....
Chandler	87	15	49.2	1.17	2.5
Chattanooga	82	15	49.4	2.65	.....
Dacoma	78	7	44.0	2.08	6.5
Erick	82	10	47.6	2.71	8.0
Fort Reno	82	− 2	45.8	1.00	2.0
Fort Sill	82	23	49.4	2.62	T.
Gage	78	− 5	42.0	2.63	8.0
Grande	80	− 4	42.2	2.45	7.0
Guthrie	88	16	48.6	2.10	2.8
Harrington	78	4	42.4	1.66	1.6
Helena	77	9	41.8	1.22	4.0
Hennessey	76	15	44.4	2.02	4.0
Hobart	79	9	47.0	2.23	1.5
Hooker	73	− 5	40.1	1.50	7.0
Jefferson	78	18	43.3	1.24	4.0
Kenton	73	4	40.2	0.74	6.0
Kingfisher	80	15	46.8	2.75	6.0
McComb	80	23	50.2	1.14	1.0
Mangum	78	10	44.4	2.40	2.0
Meeker	82	13	46.3	1.20	1.5
Neola	80	14	47.8	2.23	2.3
Newkirk	76	15	45.2	3.41	5.0
Okeene	81	11	45.6	1.89	.....
Pawhuska	78	13	46.0	1.36	4.0
Perry	80	17	45.6	2.59	1.5
Sac and Fox Agency	82	22	48.5	1.15	1.8
Shawnee	83	19	49.2	1.19	2.5
Snyder	81	15	49.8	2.46	.....
Stillwater	79	12	44.2	1.89	3.5
Taloga	76	5	42.5	2.76	8.0
Waukomis	80	14	49.2	1.95	3.5
Whiteagle	79	13	44.6	2.70	3.0
Oregon.					
Albany	65	24	45.2	.....	
Alpha	66	23	46.9	15.15	
Ashland	69	24	44.7	2.54	
Astoria	63	34	47.4	16.98	
Aurora (near)	68	24	45.7	8.86	
Bay City	59	29	46.5	21.37	2.0
Bend	66	8	37.4	1.86	4.5
Blackbutte	.....	.....	.....	8.60	
Blalock	69	24	44.2	2.17	
Bullrun	66	28	44.2	14.79	
Burns	58	− 2	29.4	0.96	3.0
Carlton	65	24	44.4	8.24	T.
Cascade Locks	68	27	44.9	17.84	
Coquille	.....	.....	.....	8.39	
Corvallis	68	23	45.6	9.35	
Dale	.....	.....	.....	2.71	6.0
Dayville	73	13	40.2	0.90	3.5
Doraville	60	25	42.8	11.17	
Drain	69	25	47.6	6.78	
Echo	68[f]	19	44.8[e]	2.82	
Ella	80	19	42.1	2.83	2.0
Eugene	67	24	46.7	5.02	
Fairview	78	24	50.0	10.19	
Falls City	62	24	43.8	17.36	
Forestgrove	65	21	43.4	9.86	
Gardiner	66	30	49.7	14.85	
Glendale	68	23	45.0	6.33	
Glenora	65	24	44.5	38.39	
Gold Beach	65	29	50.2	8.93	
Government Camp	57	13	35.2	22.57	29.
Granite	60	−11	33.4	2.77	8.0
Grants Pass	73	17	45.6	3.69	
Grass Valley	63	14	35.2	2.59	7.8
Heisler	71	13	42.8	0.79	
Heppner	71	16	41.4	1.94	3.5
Hermiston	.....	.....	.....	1.87	T.
Hood River	66	25	43.0	10.54	0.5
Huntington	69	12	39.0	1.25	5.5
Jacksonville	70	21	44.0	2.78	
Joseph	64	4	32.6	3.79	10.2
Kerby	70	22	45.8	7.93	
Lagrande	66	5	37.0	3.22	10.5
Lakeview	68	7	33.6	1.52	2.5
Lost River	64	11	38.2	0.97	2.0
McKenzie Bridge	65	19	43.4	14.94	0.5
McMinville	68	24	46.8	8.45	T.
Marshfield	69	28	50.0	9.90	
Monroe	66	24	46.7	8.82	
Mountain Park	62	24	39.8	18.38	2.0
Mount Angel	64	27	45.8	9.98	
Nehalem	.....	.....	.....	21.95	
Newport	62	30	48.3	18.49	
Odell	.....	.....	.....	1.92	24.0
Olex	70	22	40.8	1.84	1.0

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Oregon—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ontario	.....	.....	.....	0.80	3.0
Paisley	67	10	38.1	0.75	0.5
Pendleton	68	21	41.6	1.82	
Port Oxford	69	34	50.0	13.59	
Prineville	68	8	37.4	0.72	3.1
Prospect				3.55	
Richland	63	10	36.6	1.35	1.0
Riverside	68[1]	−9[1]	28.2[1]	0.35	2.0
Salem	64	27	47.1	5.99	
Silver Lake	69	0	35.2	0.42	
Sparta	66	9	35.8	1.80	9.0
Stafford	65	25	45.2	10.89	
The Dalles	73	24	44.0	3.99	
Toledo	66	29	47.2	17.13	
Umatilla	66	20	43.2	1.61	
Vale	70	1	35.8	0.89	1.5
Van	.....	.....	.....	1.82	2.5
Wallowa	64	2	34.2	3.47	6.5
Wamic	81	16	43.0	2.34	
Warm Spring	72	16	42.4	0.98	
Weston	68	21	40.5	4.29	2.0
Williams	75	18	45.6	4.08	
Pennsylvania.					
Aleppo	78	16	42.6	1.39	15.0
Altoona	74	23	40.0	0.63	.....
Baldwin	67	22	39.4	1.74	3.0
Beaver Dam	.....	.....	.....	2.16	1.5
Bellefonte	67	24	43.1	1.30	0.2
Browers Lock	.....	.....	.....	1.59	.....
California	78	23	44.4	0.84	1.0
Cassandra	70	22	39.0	1.29	8.0
Centerhall	58	22	41.0	1.33	1.8
Clarion	.....	.....	.....	1.94	1.9
Claysville	78	17	42.0	1.12	4.0
Coatsville	66	25	44.4	1.50	9.5
Confluence	.....	.....	.....	1.67	13.5
Davis Island Dam	.....	.....	.....	1.13	4.2
Derry	.....	.....	.....	1.00	2.0
Doylestown	.....	.....	.....	2.10	.....
Dushore	65	9	36.5	1.46	6.2
East Mauch Chunk	65	21	42.0	1.78	8.1
Easton	59	23	42.0	1.25	4.5
Ellwood Junction	.....	.....	.....	1.58	2.8
Emporium	70	20	40.6	1.72	1.0
Ephrata	62	21	42.9	0.65	3.1
Everett	75	23	41.4	0.88	1.0
Forks of Neshaminy	.....	.....	.....	2.15	.....
Franklin	70	18	39.8	2.57	1.0
Freeport	73	21	44.0	1.72	1.7
Gettysburg	65	25	43.3	0.73	2.5
Girardville	.....	.....	.....	1.83	8.0
Gordon	62	11	40.0	1.75	5.0
Greensboro	.....	.....	.....	1.41	1.0
Greenville	69	22	40.4	2.04	7.0
Hamburg	61	23	42.8	1.90	6.0
Hanover	70	24	45.8	0.86	3.0
Herrs Island Dam	.....	.....	.....	1.20	.....
Huntingdon	72	20	41.9	0.84	T.
Hyndman	77	21	43.0	0.85	T.
Indiana	78	20	41.8	1.33	3.5
Irwin	76	20	44.8	0.81	0.5
Johnstown	80	24	42.8	1.56	3.0
Kennett	65	25	43.7	2.40	1.8
Lansdale	.....	.....	.....	1.32	.....
Lawrenceville	.....	.....	.....	1.25	T.
Lebanon	62	22	43.8	0.83	3.6
Leroy	59	20	37.8	1.47	9.4
Lewisburg	62	19	42.8	0.83	0.5
Lockhaven	67	23	42.6	1.62	4.2
Lock No. 4	.....	.....	.....	0.68	T.
Lycippus	79	23	42.8	1.64	5.7
Marion	67	25	42.8	1.07	T.
Mifflintown	62	24	41.4	0.87	2.0
Milford	60	15	39.0	2.29	9.5
Montrose	58	10	36.1		13.0
New Germantown	65	25	43.0	0.85	2.0
Ottsville	.....	.....	.....	2.79	
Parker	.....	.....	.....	2.12	2.0
Philadelphia	67	31	46.8	2.06	1.0
Pocono Lake	59	11	35.6	1.82	12.0
Point Pleasant	.....	.....	.....	1.43	.....
Pottsville	.....	.....	.....	1.08	.....
Reading	64	20	43.7	1.17	8.0
Renovo	.....	.....	.....	1.15	T.
Saegerstown	69	15	38.6	2.93	8.5
St. Marys	68	20	38.2	1.48	6.0
Saltsburg	.....	.....	.....	0.99	1.5
Seisholtzville	.....	.....	.....	1.27	.....
Selinsgrove	62	19	43.0	1.04	1.0
Shawmont	.....	.....	.....	1.51	.....
Skidmore	68	21	40.6	1.54	2.0
Smiths Corners	.....	.....	.....	1.35	.....
Somerset	72	20	38.0	3.08	14.3
South Eaton	65	15	40.4	1.58	6.0
Springdale	.....	.....	.....	1.36	1.4
Springmount	.....	.....	.....	1.34	
State College	66	24	40.2	1.06	2.3
Towanda	63	14	38.6	1.46	3.3

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Uniontown	78	25	42.6	1.73	3.5
Warren	67	18	39.5	1.32	0.7
Wellsboro	63	18	38.2	0.99	4.3
Westchester	66	27	44.4	2.13	5.8
West Newton	.....	.....	.....	0.74	1.0
Whitehaven	61	12	38.4	2.84	4.8
Wilkesbarre	62	20	41.2	1.89	5.0
Williamsport	63	23	42.6	0.89	.....
Rhode Island.					
Bristol	61	24	42.7	2.27	f.
Kingston	54	18	40.2	3.48	T.
Pawtucket	.....	.....	.....	2.22	
Providence	67	24	42.6	2.31	3.0
South Carolina.					
Aiken	79	26	53.6	1.25	
Allendale	82	30	53.2	1.00	
Anderson	78	24	53.0	1.33	2.0
Batesburg	79	25	54.8	1.05	T.
Beaufort	81	30	58.6	0.42	
Bennettsville	81	24	53.8	0.80	
Blackville	89	29	55.8	0.90	
Blairs	.....	.....	.....	0.46	4.0
Bowman	81	25	54.1	1.08	
Calhoun Falls	.....	.....	.....	1.41	
Camden	77	26	54.0	0.71	T.
Catawba	.....	.....	.....	0.05	0.5
Chappells	.....	.....	.....	0.04	T.
Cheraw	80	22	52.6	0.65	
Clarks Hill	79[c]	24[c]	52.8[c]	0.97	
Clemson College	75	24	51.0	1.66	4.0
Conway	81	26	54.1	2.15	
Darlington	80[d]	23[d]	51.1[d]	1.01	
Dillon	82[g]	22[g]	53.0[g]	1.33	
Due West	77	25	54.7	2.23	1.8
Edisto	.....	.....	.....	0.91	
Effingham	.....	.....	.....	0.75	
Enoree	.....	.....	.....	0.70	3.0
Georgetown	80	29	55.6	0.50	
Greenville	75	20	47.9	1.30	4.0
Greenwood	75	24	50.9	0.72	
Kingstree	80	35	59.6	0.90	
Liberty	76	21	50.8	1.67	4.0
Little Mountain	77	27	54.4	0.69	4.0
Newberry	78	23	52.6	0.79	1.0
Pelzer	.....	.....	.....	1.05	1.0
St. Georges	80	29	56.2	1.06	
St. Matthews	79	28	54.0	0.94	
St. Stephens	.....	.....	.....	0.90	
Saluda	79	21	52.4	0.76	1.0
Santuck	79	21	51.8	0.88	1.2
Smiths Mills	.....	.....	.....	2.25	
Society Hill	78	25	52.4	0.88	
Spartanburg	81	22	52.0	0.94	3.3
Stateburg	79	30	55.8	1.44	
Summerville	85	25	56.0	0.70	
Sumter	84	26	57.6	1.23	
Trenton	78	28	53.2	1.04	
Trial	84	25	55.2	1.24	
Walhalla	77	22	52.9	2.36	3.0
Walterboro	86	25	57.3	0.73	
Winnsboro	76	28	54.0	T.	
Winthrop College	80	22	52.8	0.63	0.8
Yemassee	80	26	54.3	0.53	
Yorkville	82	27	55.2	0.96	2.0
South Dakota.					
Aberdeen	60	−1	29.6	0.86	.....
Academy	69	5	34.8	0.43	0.2
Alexandria	62	5	31.9	0.94	0.5
Ashcroft	60	1	30.0	0.44	2.0
Bowdle	68	−2	30.7	1.07	5.0
Brookings	60	−3	29.6	0.89	5.5
Canton	68	9	33.2	0.62	1.0
Castlewood	57	−2	28.6	0.92	3.2
Centerville	62	10	33.3	0.37	2.1
Chamberlain	66	5	34.5	0.41	0.2
Cherry Creek	73	4	34.6	0.10	T.
Clark	57	−3	29.4	0.96	4.0
Clear Lake	57	−2	27.0	0.66	4.0
Desmet	58	1	30.2	1.20	1.0
Doland	54	−2	29.5	1.31	5.6
Elkpoint	67	11	34.0	1.60	4.0
Fairfax	61	3	34.4	0.55	T.
Farmingdale	.....	.....	.....	0.35	T.
Faulkton	60	0	29.5	0.46	.....
Flandreau	59	0	28.8	0.91	4.5
Forestburg	61	−2	30.4	0.65	T.
Fort Meade	64	4	33.2	0.92	2.2
Frederick	70	−4	28.8	.....	.....
Greenwood	70	9	37.0	1.02	
Hermosa	70	2	35.0	0.20	
Highmore	64	0	32.2	0.36	2.0
Howard	58	2	30.0	1.05	1.0
Howell	60	−3	29.7	0.41	1.5
Ipswich	60	−4	28.4	0.25	0.6
Kennebec	70	1	33.8	0.30	T.
Kidder	61	0	28.2	1.23	4.0
Kimball	60	−5	33.6	0.35	
Leola	60	−3	27.1	1.40	2.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Little Eagle	69	−5	29.8	0.53	3.1
Marion	67[d]	8[d]	34.4[d]	0.85	1.4
Mellette	59	−3	28.6	0.57	1.0
Menno	66	10	35.6	1.08	1.1
Milbank	63	−2	29.6	1.13	4.0
Mitchell	65	5	34.4	1.58	.....
Oelrichs	67	3	33.7	0.28	T.
Orman	72	−1	33.4	0.93	T.
Pine Ridge	.....	.....	.....	0.51	2.0
Plankinton	60	4	33.1	0.50	T.
Ramsey	60[c]	3[c]	31.4[c]	1.25	4.0
Redfield	59	−3	28.6	0.59	3.5
Roslyn	56	−1	27.4	1.01	3.5
Sioux Falls	64	5	32.2	0.89	T.
Spearfish	64	6	35.8	0.91	T.
Stephan	63	−4	30.9	0.14	0.9
Tyndall	64	9	36.0	0.63	T.
Vermillion	68	12	38.4	0.12	1.2
Watertown	54	−2	28.0	0.75	2.0
Wentworth	60	2	30.6	0.80	7.0
Whitehorse	67	−6	30.0	0.35	1.3
Woolsey	.....	.....	.....	0.46	1.0
Tennessee.					
Andersonville	79	23	49.0	5.60	4.0
Ashwood	77	22	48.3	4.70	6.0
Benton	80	20	49.5	4.93	5.0
Bluff City	.....	.....	.....	3.85	2.8
Bolivar	78	21	47.6	14.98	
Bristol	78	20	46.3	4.53	3.0
Brownsville	73	23	48.4	9.87	
Byrdstown	79	23	48.5	4.10	3.0
Carthage	82	28	50.6	4.10	1.0
Cedar Hill	79	22	48.8	7.80	3.0
Celina	.....	.....	.....	4.71	
Charleston	.....	.....	.....	3.53	4.0
Clarksville	77	23	47.7	9.99	4.0
Clinton	.....	.....	.....	3.95	4.0
Covington	74	22	48.8	13.15	
Decatur	78	19	48.1	3.13	4.0
Dover	80	19	48.2	13.11	4.5
Dyersburg	74	23	47.6	12.63	3.5
Elizabethton	82	20	48.9	1.83	4.0
Erasmus	75	12	45.5	3.50	2.6
Florence	77	22	48.3	5.33	3.0
Franklin	77	23	47.6	5.86	5.0
Greeneville	78	19	47.8	3.63	1.5
Halls Hill	.....	.....	.....	3.37	2.0
Harriman	76	23	49.3	4.05	3.5
Hohenwald	77	12	46.2	7.86	7.0
Iron City	79	19	50.2	3.52	6.0
Jackson	82	21	51.8	11.28	2.5
Johnsonville	78	24	48.4	11.90	4.6
Jonesboro	.....	.....	.....	3.20	1.5
Kenton	78	21	48.6	13.09	3.0
Kingston	.....	.....	.....	3.55	3.5
Lafayette	79	20	48.1	4.99	3.0
Lewisburg	78	20	50.0	3.10	6.0
Loudon	.....	.....	.....	3.25	3.0
Lynnville	76	24	48.2	2.96	6.0
McGee	.....	.....	.....	6.90	4.0
McMinnville	81	21	49.8	2.97	4.0
Maryville	82	21	48.7	5.21	3.0
Milan	73	23	46.6	13.10	4.0
Monterey	75	22	48.8	3.01	2.0
Newport	79	25	48.2	4.03	2.0
Palmetto	79	20	50.2	3.03	4.5
Pinewood	78	20	48.4	.....	6.0
Pope	78	19	48.4	11.51	5.0
Rogersville	80	20	45.7	5.26	2.5
Rugby	77	18	45.2	2.60	4.0
Savannah	75[e]	21	50.0	7.03	0.6
Sevierville	86	20	48.2	4.30	2.2
Sewanee	71	24	49.8	3.00	4.5
Silver Lake	74	14	42.8	3.03	4.5
Sparta	78	20	49.8	3.20	2.5
Springdale	73	19	43.9	4.21	3.0
Springville	77	23	47.4	13.89	4.0
Tazewell	.....	.....	.....	4.86	4.9
Tellico Plains	82	21	50.6	5.65	4.5
Tracy City	77	17	46.2	3.37	5.5
Trenton	77	20	48.2	13.79	4.0
Tullahoma	78	20	49.5	2.89	5.5
Union City	79[f]	22[f]	47.6[f]	11.51	3.0
Walling	.....	.....	.....	3.88	2.2
Watertown	78	22	50.8	2.50	1.0
Waynesboro	76	18	49.2	5.07	3.5
Wildersville	74	25	48.6	12.18	4.0
Yukon	79	24	50.6	2.86	5.0
Texas.					
Albany	86	17	51.9	2.05	
Alvin	.....	.....	.....	0.47	
Arthur	.....	.....	.....	1.60	
Austin	82	36	60.8	1.57	
Ballinger	86	15	55.6	1.25	T.
Barstow	85	20	49.8	1.46	5.0
Beaumont	.....	.....	.....	1.03	
Beeville	92	24	62.4	2.49	
Big Springs	83	14	50.4	2.96	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Texas—Cont'd.					
Blanco	86	29	56.2	1.26	
Boerne	90	21	55.8	1.20	
Bonham	84	24	54.4	1.42	T.
Booth				0.70	
Bowie	85	14	53.7	1.64	1.0
Brazoria	87	31	64.2	0.25	
Brenham	86	30	60.2	1.91	
Brighton	83	33	65.7	6.58	
Brownsville	98	38	70.2	0.24	
Brownwood	82	17	52.6	1.33	1.0
Canadian	74	— 2	43.6	3.15	9.0
Channing	77	— 2	42.2	1.55	8.0
Childress	82	6	46.4	2.58	4.0
Clarksville	86	28	53.5	3.15	T.
Claude				2.50	16.0
Claytonville	77	12	53.6	3.46	
Coleman	83	22	55.2	1.73	T.
College				1.21	
Colorado	86	15	52.2	2.33	T.
Columbus				2.13	
Corsicana	87	27	56.6	3.40	T.
Cotulla	82	27	63.9	2.81	
Crockett	87	28	61.0	0.98	
Cuero	86	26	69.8	1.69	
Dallas	88	25	54.3	2.45	1.0
Denison				0.70	
Dialville	82	29	57.9	1.89	
Duval	85	26	59.4	2.48	
Eagle Pass	90	24	63.2	1.30	
Fort Clark	88	21	59.5	1.11	
Fort McIntosh	101	21	64.6	2.25	
Fredericksburg	84	20	56.1		
Gatesville	84	23	56.4	2.10	T.
Georgetown	88	24	58.6	1.58	
Gonzales				1.02	
Graham	90	14	53.9	2.15	0.8
Grapevine	89[d]	21[d]	55.4[d]	2.16	1.2
Greenville	87	26	54.9	3.22	
Hale Center				2.23	15.0
Hallettsville	86	27	62.2	1.91	
Haskell	81	17	50.2	3.82	0.2
Hearne				2.23	
Henrietta	85	7	47.6	1.87	1.0
Hewitt				1.46	T.
Hillsboro	86	23	57.0	2.74	0.5
Hondo	84	24	59.5	0.70	
Hubbard	88	26	57.8	3.03	T.
Huntsville	87	29	58.8	1.15	
Jefferson	82	27	55.4	1.51	
Jewett	86	26	58.5	1.80	
Kaufman	84	26	57.8	5.05	0.5
Kent	81	4	50.6	2.80	8.0
Kerrville				1.93	
Knickerbocker	86	18	53.5	1.52	
Kopperl				2.38	
Lampasas	89	22	56.2	1.62	T.
Lapara				3.78	
Liberty	85	30	63.6	0.75	
Llano	85	23	57.8	1.00	T.
Longlake				1.75	
Longview	83	32	55.3	1.34	
Lufkin	85	30	60.9	2.34	
Luling	84	27	60.6	0.96	
Marlin	88	26	58.8	1.95	
Mexia	84	25	55.6	1.94	
Miami	77	11	42.6	3.21	13.0
Mount Blanco	80	5	45.4	1.94	7.0
Nacogdoches	83	27	58.0	1.91	
Nazareth	78	0	42.5	2.29	14.6
New Braunfels	86	28	60.4	1.81	
Paris	94	30	55.0	3.60	
Pierce	86	27	62.6	0.83	
Plemons	78	— 9	41.2	1.31	5.0
Port Lavaca	83[c]	29[c]	63.4[c]	0.90	
Rhineland	86	17	50.0	4.25	
Riverside				T.	
Rockisland	88	26	62.6	1.44	
Rockland				1.33	
Rockport	80	40	66.9	2.80	
Sabinal	99	22	59.3	1.84	
San Marcos	84	24	59.5	2.23	
San Saba	90	17	55.6	1.34	0.8
Santa Gertrude				3.30	
Seymour	84	18	50.0	2.41	
Sherman	82	27	56.5	1.66	0.5
Sonora	85	12	54.6	0.81	
Sulphur Springs	85	28	55.1	2.36	T.
Temple	86	20	56.9	1.08	
Texline	75	0	40.8	0.80	
Tilden				1.73	
Victoria	90	27	62.9	1.26	
Waco	86	29	57.9	2.00	T.
Waxahachie	90	23	53.6	3.35	T.
Weatherford	82	20	53.2	1.69	0.8
Willspoint	84	25	55.8	3.28	T.
Utah.					
Alpine				2.50	4.0
Aneth	71	14	43.8	1.01	5.8
Utah—Cont'd.					
Beaver	75	10	42.6	0.85	8.5
Blackrock	75	— 7	35.4	2.11	
Castledale				1.50	
Castle Rock				1.74	10.5
Cedar City	70	4	36.7	? 07	15.5
Corinne	71	7	38.8	0.82	8.0
Deseret	79	1	34.0	1.38	7.0
Emery	65	4	34.1	2.00	20.0
Enterprise				1.74	17.0
Escalante	72	1	36.2	2.31	18.5
Farmington	64	9	41.3	2.35	23.5
Fillmore	81	8	39.5	2.93	
Fort Duchesne	70	— 9	32.6	1.83	12.5
Garrison	72	— 5	35.2	0.88	11.0
Government Creek	64	— 1	34.7	2.60	13.0
Grayson	65	9	39.0	4.31	10.5
Heber	65	— 6	32.4	1.54	12.0
Henefer	68	—10	32.6	2.43	12.0
Huntsville				1.23	9.0
Ibapah	60	— 9	29.0	3.81	40.0
Indianola				0.17	
Kelton				0.30	3.0
La Sal	61	3	34.8	1.41	17.5
Levan	64	5	35.0	1.57	8.5
Loa	60	—10	29.0	0.90	9.0
Logan				1.07	
Manti	67	5	35.8	1.73	8.0
Marion				2.86	19.0
Marysvale	75	— 4	34.4	1.09	12.8
Meadowville	60	— 9	30.8	0.75	3.0
Milford	73	— 2	32.7	1.45	14.5
Millville				1.06	
Minersville				0.96	9.5
Moab	71	10	42.4	1.75	4.0
Morgan	66	— 9	33.8	2.71	21.0
Mount Nebo	67	9	37.8	1.17	5.5
Mount Pleasant	65	4	35.0	1.26	7.0
Nephi				1.47	9.5
Oak City	67	3	36.4	2.15	
Ogden	63	9	37.6	2.78	12.3
Panquitch				1.60	11.5
Parowan	66	0	35.8	2.09	14.4
Park City				2.15	37.5
Payson				3.14	10.0
Pinto	68	—13	32.7	2.43	21.5
Plateau	68	—18	32.0	1.98	17.2
Provo	75	8	38.0	3.20	20.0
Ranch	70	— 8	31.5	2.16	
Randolph				0.46	2.0
Richfield	74	3	31.9	0.39	3.0
Rockville	78	11	46.4	1.50	
St. George	78	25	46.8	1.21	2.8
Salt Air	68	12	40.1	1.53	3.5
San Juan				2.96	22.0
Scipio	68	— 4	36.0	1.99	6.0
Snowville	67	— 2	34.2	0.40	4.0
Strawberry Valley	69	— 4	28.8		
Sunnyside				3.80	27.0
Theodore	65	—10	32.4	2.31	15.5
Thistle	90	— 2	38.6	0.81	
Tooele	68	10	37.2	1.84	
Tropic	70	4	37.0	1.90	19.0
Trout Creek	73	— 5	34.4	2.20	6.0
Vernal	60	3	32.6	2.77	9.0
Vermont.					
Bloomfield	51	2	31.5	1.41	16.0
Cavendish	55	9	33.8	2.36	14.0
Chelsea	52	10	30.4	2.24	18.0
Cornwall	54	8	35.0	2.46	13.5
Enosburg Falls	58	2	31.5	3.33	23.0
Jacksonville	52	15	35.8	1.70	27.7
Manchester	60	14	34.4	1.95	9.0
Norwich	67	6		2.02	13.0
St. Johnsbury	53	6	33.0	1.74	9.0
Wells	54	10	32.0	2.12	9.5
Westfield	54	10		4.04	28.5
Woodstock	50	14	32.3	2.03	9.0
Virginia.					
Arvonia	81	20	47.2	2.76	1.0
Ashland	79	25	47.4	1.83	1.0
Barboursville	78	26	48.6	2.27	0.2
Bigstone Gap	77	19	46.0	7.00	10.0
Blacksburg	76	18	43.4	2.23	2.0
Buchanan				1.68	1.0
Burkes Garden	72	12	40.0	3.97	3.0
Callaville	80	24	51.8	0.28	
Charlottesville	81	29	51.0	2.70	1.5
Clarksville				0.67	1.0
Columbia	80	24	47.2	2.93	0.5
Dale Enterprise	78	20	45.2	1.79	2.0
Danville				0.46	0.5
Dinwiddie	78	17	47.6	0.88	1.0
Doswell	82	21	48.6	2.49	0.5
Elk Knob	74	22	47.2	5.27	3.0
Farmville				0.80	T.
Fredericksburg	77	24	47.4	1.64	0.5
Grahams Forge	77	16	44.1	2.00	4.0
Hampton	74	32	50.0	1.32	
Virginia—Cont'd.					
Hot Springs	73	20	42.6	2.27	2.0
Ivanhoe				2.41	4.4
Lexington	79	21	45.4	1.67	1.0
Lincoln	70	24	46.4	1.74	T.
Marion	79	17	46.0	3.25	2.5
Milford				2.41	1.8
Newport News	75	33	50.7	1.30	
Nokesville (near)	74	26	46.4	1.73	T.
Petersburg	80	17	46.4	0.73	0.5
Quantico	74	25	45.8	2.38	T.
Radford				2.42	3.0
Randolph				0.25	2.0
Riverton				1.30	
Roanoke	80[d]	27[d]	49.2[d]	2.20	2.0
Rockymount	78	22	49.2	3.19	2.0
Shenandoah				2.28	T.
Skyland				2.48	3.0
Speers Ferry				6.00	7.0
Spottsville	79	21	49.4	1.15	
Staunton	78	22	47.7	2.10	2.0
Stephens City	77	23	47.1	1.39	T.
Warsaw	78[c]	24[c]	48.7[c]	2.40	T.
Williamsburg	80	29	49.1	0.90	T.
Woodstock	77	25	47.1	1.64	T.
Washington.					
Aberdeen	62	28	44.8	15.92	
Anacortes	60	28	43.0	4.95	
Ashford				15.04	
Baker	59	17	37.7	11.81	0.1
Bellingham	60	25	45.2	4.89	
Blaine	59	24	42.8	6.34	
Bogachiel	60	28	44.2	21.76	
Brinnon	58	27	42.2	15.54	
Cedar River				9.40	
Cedonia	59[d]	10[d]	35.0[d]	3.99	2.5
Centralia	62	25	44.0	11.17	
Cheney	70	8	36.8	3.46	35.0
Clearbrook	60	20	40.8	7.48	1.0
Clearwater	58	29	44.4	21.92	
Cle Elum	56	15	35.6	7.87	4.5
Colfax	64	5	37.9	5.16	2.5
Colville	53	5	32.2	3.15	4.5
Conconully	58	11	33.4	3.71	T.
Coupeville	60	29	44.6	4.23	
Crescent	54	8	33.3	3.14	4.0
Easton				11.50	8.0
East Sound	60	24	41.9	6.25	
Ellensburg	57	14	36.5	3.20	
Ephrata	62	11	37.9	0.74	
Fort Simcoe	63	18	39.0	5.41	
Goldendale	63	9	39.4	4.54	1.1
Granite Falls				8.97	
Hatton	63	12	37.8	1.48	1.0
Kennewick	62[b]	20[b]	37.3[b]	1.69	T.
Kiona	66	18	41.0	2.19	
Kosmos	68	25	43.2	15.21	
Lacenter	61	23	42.7	11.32	T.
Lakeside	64	25	40.1	3.88	
Lester	60	20	40.0	13.95	12.0
Loomis	66	20	42.1	4.75	T.
Merritt				14.15	10.0
Mottinger Ranch	69	23	42.9	1.89	
Mount Pleasant	66	28	45.0	12.15	T.
Moxee	65	13	38.5	2.19	T.
Northport	56	3	30.8	3.37	5.7
Odessa	68	14	35.0	1.60	
Olga	58	30	41.4	5.62	
Olympia				16.43	
Pinehill	69	23	42.6	7.24	0.8
Pomeroy	65	19	39.4	3.78	0.2
Port Townsend	60	31	44.0	4.01	
Pullman	65	8	35.9	7.31	6.2
Quiniault	58	13	42.5	24.03	
Rattlesnake				2.34	2.2
Republic	54	8	30.6	2.35	2.0
Rex Creek				8.99	T.
Retzville				2.67	4.0
Rock Lake				3.80	2.0
Rosalia	56	6	34.6	4.42	4.0
Ruby Hill	53	13	31.0	3.98	T.
Sedro	60	25	42.3	6.01	
Sixprong	65	20	42.8	2.27	T.
Snohomish	65	25	43.2	8.37	
Snoqualmie	60[c]	27[c]	42.6[c]		
Stokes	53	12	33.3	6.72	4.0
Sunnyside	65	14	40.0	1.84	T.
Twisp	57	12	34.0	5.09	1.0
Union	63	25	43.0	17.00	
Vancouver	67	23	45.3	9.42	
Vashon	61	32	45.0	10.88	T.
Wahluke	65	15	40.2	1.10	0.5
Waterville	54	14	32.9	2.82	T.
Wenatchee (near)	57	15	35.6	4.62	1.5
Wilbur	55	5	31.4	2.83	2.8
Winthrop	58	10	32.8	6.13	
Yale	64	27	44.2	22.66	0.5
Zindel	67	19	43.3	2.89	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
West Virginia.					
Bancroft	82	22	45.2	2.35	T.
Bayard	74	17	39.6	2.23	9.0
Beckley	78	16	43.0	3.69	3.0
Bens Run	78	23	44.7	2.52	1.0
Berkley Springs	73	24	45.1	0.78	T.
Burlington	76	18	44.8	1.20	1.0
Cairo	...	18[f]	44.2[f]	2.32	
Central	78	16	42.5	2.34	1.0
Charleston	80	25	48.0	1.97	T.
Creston	78	18	43.8	1.90	
Cuba	79	17	44.0	2.60	1.1
Davis	...	...	...	2.00	T.
Elkhorn	77	21	46.4	3.84	5.5
Fairmont	80	20	44.4	2.10	2.0
Franklin	78[1]	21[1]	45.6[1]	1.78	T.
Glenville	81	19	45.8	2.93	1.5
Grafton	79	20	44.2	2.56	3.5
Green Sulphur Springs	77	18	44.2	2.49	
Harpers Ferry	...	...	...	0.35	T.
Hinton	73	24	46.2	4.24	4.0
Huntington	77	22	43.9	2.88	T.
Leonard	68	20	40.8	3.70	4.0
Lewisburg	73	17	43.8	3.08	2.8
Logan	77	25	49.0	3.10	2.0
Lost City	75	21	43.6	0.80	T.
Lost Creek	81	17	43.7	3.02	1.5
Mannington	77	17	43.2	1.99	2.8
Martinsburg	68	26	43.8	0.85	
Moorefield	81	15	43.9	1.00	T.
Mooresville	...	...	...	2.23	T.
Morgantown	78	24	44.2	1.62	1.0
Moundsville	76	21	43.8	1.32	1.0
New Cumberland	74	20	42.7	0.67	T.
New Martinsville	76	22	44.5	1.78	1.0
Nuttallburg	62	20	40.4	2.49	4.0
Oceana	76[f]	22[f]	47.8[f]	3.32	0.2
Parsons	78	18	42.4	2.00	5.0
Philippi	79	18	43.4	2.49	4.7
Pickens	73	13	40.4	4.34	11.0
Point Pleasant	80	23	46.2	2.63	T.
Powellton	79	23	46.6	2.05	...
Princeton	72	16	40.1	5.50	5.0
Romney	74	23	44.0	0.97	...
Rowlesburg	...	...	...	2.53	5.8
Ryan	81	17	44.6	2.44	
Smithfield	...	...	...	2.84	1.8
Southside	81	19	44.9	1.98	T.
Spencer	80	14	41.4	2.80	1.2
Sutton	84	22	47.2	3.10	2.0
Terra Alta	76	19	44.7	4.13	6.8
Union	73	15	40.3	2.76	2.5
Uppertract	80	16	44.8	1.02	T.
Wellsburg	72	22	41.6	1.30	2.2
Weston	84	20	44.1	2.98	2.5
Wheeling	84	28	49.0	0.75	0.7
Williamson	76	25	46.6	4.08	T.
Wisconsin.					
Amherst	57[e]	12[e]	34.4[e]	3.87	3.0
Antigo	55	10	31.6	2.45	17.0
Appleton	58	16	35.5	4.19	2.3
Appleton Marsh	64	10	33.4	3.11	8.7
Ashland	58	13	33.4	2.90	...
Barron	58	8	32.8	0.43	4.3
Beloit	65	21	37.2	2.06	T.
Brodhead	67	16	36.8	3.12	T.
Burnett	63	15	35.2	3.22	3.0
Butternut	69	5	31.6	3.37	16.0
Chilton	60	19	35.8	4.37	1.0
Chippewa Falls	...	...	...	3.17	6.0
Downing	55[d]	9	38.0[b]	1.68	4.5
Eau Claire	62	7	34.2	2.75	4.8
Florence	53	10	31.8	3.45	13.0
Fond du Lac	...	...	...	3.45	0.5
Grand Rapids	63	8	33.8	3.48	4.0
Grand River Locks	...	...	...	4.07	2.0
Grantsburg	62	10	30.4	1.93	9.5
Hancock	59	8	34.0	4.02	4.0
Harvey	63	17	36.0	3.10	0.1
Hayward	57	6	30.2	2.57	6.8
Hillsboro	66	4	33.7	2.82	5.0
Koepenick	60	4	33.4	4.20	20.0
Lancaster	65	5	34.0	3.54	4.0
Manitowoc	53	21	34.0	3.60	T.
Mauston	65	15	35.8	2.01	4.0
Meadow Valley	58	6	33.2	3.01	6.0
Medford	65	9	33.6	1.90	5.0
Menasha	...	...	...	2.93	2.0
Merrill	51	4	31.8	2.84	9.5
Minocqua	51	12	31.1	0.90	9.0
Mount Horeb	61	9	35.2	2.60	4.0
Neillsville	64	0	33.7	3.45	8.0
New London	60	14	35.5	4.54	6.0
New Richmond	64	8	34.0	2.92	4.0
Oconto	52	17	35.4	4.31	...
Osceola	65	9	34.4	1.77	2.0
Oshkosh	60	15	35.5	3.70	T.
Pine River	60	12	35.2	3.99	1.8

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Wisconsin—Cont'd.					
Portage	65	15	36.1	2.52	4.0
Port Washington	56	18	37.0	4.30	...
Prairie du Chien	70	7	36.8	3.01	5.0
Prentice	58	5	30.3	1.76	7.8
Racine	63	19	38.8	2.92	...
Sheboygan	57	22	38.4	3.57	T.
Shullsburg	67	11	35.2	2.90	2.0
Solon Springs	52	2	28.0	1.39	6.5
Spooner	59	8	31.0	2.44	10.2
Stanley	62	— 1	32.0	2.83	9.0
Stevens Point	61	8	33.0	4.96	8.0
Sturgeon Bay	52	21	37.2	6.72	6.0
Valley Junction	68	10	33.4	3.20	9.0
Viroqua	65	7	34.2	2.44	6.3
Watertown	67	16	35.6	3.28	2.0
Waukesha	...	...	...	2.54	T.
Waupaca	57	14	35.2	4.59	3.2
Wausau	58	11	33.4	3.53	11.2
Weyerhauser	57	— 4	26.9	1.14	7.0
Whitehall	67	1	34.0	2.87	7.0
Wyoming.					
Afton	65	— 8	29.8	1.50	5.0
Alcova [d]	65	1	36.8	0.20	2.0
Barnum	...	...	...	0.02	T.
Bedford	61[e]	—11[e]	25.8[e]	1.42	3.7
Border	61	—11	29.0	0.75	...
Cheyenne Ex. Farm	...	...	...	0.78	5.0
Chugwater	65	—10	31.2	2.05	11.5
Clark	62	4	34.6	0.27	1.0
Clear Creek Cabin	56	—14	25.4	1.29	13.0
Corbette	61	0	32.4	0.22	1.0
Daniel	54	—14	22.5	0.80	17.5
Dubois	...	...	...	0.27	0.5
Elk Mountain	...	...	...	1.20	22.5
Embar	68	— 7	30.8	0.20	2.0
Evanston	59	—10	28.2	1.19	9.0
Fontenelle	58	—10	28.0	0.35	3.5
Fort Laramie	66	0	33.6	0.94	1.0
Fort Washakie	64	— 6	29.8	0.25	2.5
Granite Canyon	58	—10	30.8	1.65	12.0
Granite Springs	69	— 3	32.9	1.72	21.5
Green River	62	— 4	30.9	2.00	17.2
Griggs	65	— 7	31.8	0.04	T.
Hatton	...	...	...	1.42	10.0
Hyattville	68	3	35.8	...	...
Jackson	58	— 3	29.8	0.82	6.5
Kirtley	61	0	33.4	0.29	1.0
Laramie	58	—11	29.0	0.41	4.8
Leo	56	—10	29.8	0.68	1.5
Little Medicine	53	—20	25.1	1.08	14.0
Lolabama Ranch	55	—12	25.7	0.35	...
Lusk	62	— 6	31.8	0.65	1.0
Moore	63	— 5	34.0	1.21	11.8
New Castle	63	— 1	33.8	0.21	T.
Pathfinder	66	— 7	33.3	0.26	7.7
Phillips	65	— 6	32.6	1.49	...
Pine Bluff	69	0	34.4	1.06	6.0
Pinedale	52	— 9	23.7	0.70	2.0
Rawlins	62	0	31.1	0.45	5.0
Saratoga	59	— 7	31.8	1.24	8.5
Sheridan	67	1	33.7	0.70	...
Shoshone Canyon	64	3	34.0	0.20	0.5
South Pass City	48	—10	17.9	0.30	3.0
Wells	48	—19	20.8	1.29	6.1
Wheatland	70	1	37.0	1.40	13.0
Wolf	67	9	35.6	0.63	...
Wyncote	63	— 2	32.8	0.89	2.7
Yellowstone Pk. (F'tain)	...	...	...	0.75	7.5
Yellowstone Pk. (G'd Cn.)	51	—20	18.6	0.66	8.1
Yellowstone Pk. (Lake)	51	— 7	24.0	1.95	8.0
Yellowstone Pk. (Norris)	60	—25	22.6	0.04	...
Yellowstone Pk (Riv'side)	52	—19	23.8	1.37	10.2
Yellowstone Pk (Snake R.)	57	—21	19.8	1.50	10.4
Yellowstone Pk. (Thumb)	50	—14	22.4	1.20	12.0
Yellowstone Pk. (Up. B.)	49	—17	23.2	0.61	6.0
Porto Rico.					
Adjuntas	83	64	74.2	8.67	
Aguirre	97	69	82.0	4.99	
Albonita	84	55	70.7	8.40	
Anasco	92	65	78.2	2.88	
Arecibo	95	60	76.0	7.50	
Bayamon	95	63	77.0	6.51	
Caguas	92	60	75.2	5.05	
Canovanas	90	71	79.0	5.68	
Cayey	90[n]	60[n]	73.0[n]	6.45	
Cidra[e]	95	72	81.0	...	
Fajardo	92	69	80.4	5.04	
Guanica	91	62	77.6	0.97	
Hacienda Josefa	...	...	...	4.42	
Humacao	88	68	77.6	5.43	
Isabel	96	69	80.4	2.79	
Isolina	91	61	74.2	7.66	
Juana Diaz	95	70	81.6	6.86	
La Carmelita	87	64	74.9	6.86	
Lares	91	61	76.2	5.91	
Las Cruces	86	66	78.1	7.34	
Las Marias	90	62	75.4	2.90	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Porto Rico—Cont'd.					
Manati	97	66	78.2	6.69	
Maunabo	93	68	80.8	3.70	
Mayaguez	91	62	78.1	2.19	
Rio Blanco	90	63	77.8	9.23	
Rio Piedras	...	...	...	5.56	
San German	94	64	79.2	6.27	
San Lorenzo	96	59	76.7	6.96	
San Salvador	88	62	73.6	7.60	
Santa Isabel	92[e]	67[e]	79.4[e]	2.38	
Vieques	96	70	80.8	2.19	
Yabucoa	...	...	...	5.96	
Yauco	91[e]	63[e]	77.4[e]	3.68	
New Brunswick.					
St. John	54	15	34.6	4.93	7.6
Nicaragua.					
Bluefields	90	72	79.3	20.33	

Late reports for October, 1906.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.					
Coal Harbor	57	31	42.9	4.44	
Copper Center	58	9	30.9	0.74	4.8
Fairbanks	58	2	31.8	0.30	3.6
Fort Liscum	52	27	39.7	8.51	0.5
Holy Cross Mission	44	10	30.0	0.11	0.1
Juneau	...	...	...	12.30	
Kenai	53	10	38.1	1.74	T.
Loring	57	31	43.0	20.49	
Skagway	63	30	44.0	5.36	
Sunrise	54	18	38.0	6.67	5.0
Wood Island	59	31	44.5	6.70	
California.					
Idylwild	86	28	59.6	0.03	
Imperial	111	36	73.8	...	
Milo	...	...	...	0.00	
San Miguel	...	...	...	0.00	
West Point	...	...	...	0.16	
Florida.					
Flamingo	93	60	78.6	...	
Orange City	98	45	73.6	1.59	
Idaho.					
Roosevelt	68	9	40.2	1.05	
Louisiana.					
Reserve	89	41	65.4	1.45	
Michigan.					
Isle Royal	67	25	44.4	3.23	T.
Montana.					
Ericson	...	...	...	0.25	
Lake McDonald	...	...	...	1.98	
Ridgelawn	82	16	47.8	T.	
Nebraska.					
Bloomfield	84	14	49.0	3.54	
New Hampshire.					
Grafton	74	16	46.6	2.86	T.
New Mexico.					
Albuquerque	84[k]	35[k]	59.3[k]	0.52	
Rosa	...	...	...	0.50	...
New York.					
Wading River	75	27	53.2	8.09	
North Dakota.					
New Salem	84	16	46.4	0.29	
Washington.					
Clearwater	77	32	53.3	22.42	
Stehekin	70	27	48.8	3.95	

EXPLANATION OF SIGNS.

[e] Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[n]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

TABLE III.—*Wind resultants, from observations at 8 a. m and 8 p. m., daily, during the month of November, 1906.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	Hours.	Hours.	Hours.	°	Hours.
New England.						
Eastport, Me	30	6	9	26	n. 35 w.	29
Portland, Me	32	8	4	29	n. 46 w.	35
Concord, N. H.†	16	5	3	17	n. 52 w.	18
Burlington, Vt.†	15	8	10	3	n. 45 e.	10
Northfield, Vt	37	13	6	14	n. 18 w.	25
Boston, Mass	23	8	5	37	n. 65 w.	35
Nantucket, Mass	24	8	7	31	n. 56 w.	29
Block Island, R. I	26	9	5	37	n. 62 w.	36
Providence, R. I	26	6	7	36	n. 55 w.	35
Hartford, Conn	30	11	5	25	n. 46 w.	28
New Haven, Conn	32	7	6	22	n. 33 w.	30
Middle Atlantic States.						
Albany, N. Y	34	11	4	23	n. 40 w.	30
Binghamton, N. Y.†	9	2	7	16	n. 52 w.	11
New York, N. Y	24	6	6	38	n. 61 w.	37
Harrisburg, Pa	25	4	11	33	n. 46 w.	30
Philadelphia, Pa	25	11	6	33	n. 63 w.	30
Scranton, Pa	30	13	12	20	n. 25 w.	19
Atlantic City, N. J	26	7	5	36	n. 59 w.	36
Cape May, N. J	27	13	3	32	n. 64 w.	32
Baltimore, Md	28	9	8	32	n. 51 w.	31
Washington, D. C	30	12	6	24	n. 45 w.	26
Lynchburg, Va	16	18	15	26	s. 80 w.	11
Mount Weather, Va	27	14	6	31	n. 63 w.	28
Norfolk, Va	26	18	8	14	n. 37 w.	10
Richmond, Va	23	20	10	17	n. 67 w.	8
Wytheville, Va	14	11	7	39	n. 85 w.	32
South Atlantic States.						
Asheville, N. C	30	20	11	13	n. 11 w.	10
Charlotte, N. C	22	21	6	16	n. 84 w.	10
Hatteras, N. C	35	10	8	20	n. 26 w.	28
Raleigh, N. C	26	21	3	20	n. 74 w.	18
Wilmington, N. C	28	15	8	19	n. 40 w.	17
Charleston, S. C	28	15	15	10	n. 21 e.	14
Columbia, S. C	23	16	14	19	n. 36 w.	9
Augusta, Ga	24	14	13	23	n. 45 w.	14
Savannah, Ga	25	18	20	17	n. 14 e.	12
Jacksonville, Fla	33	10	23	10	n. 29 e.	26
Florida Peninsula.						
Jupiter, Fla	18	9	38	8	n. 73 e.	31
Key West, Fla	32	5	42	2	n. 56 e.	48
Tampa, Fla	34	5	33	7	n. 42 e.	39
Eastern Gulf States.						
Atlanta, Ga	16	12	26	19	n. 60 e.	8
Macon, Ga.†	18	7	4	7	n. 15 w.	11
Thomasville, Ga	27	12	25	13	n. 39 e.	19
Pensacola, Fla.†	16	4	16	2	n. 49 e.	18
Anniston, Ala	19	25	21	9	s. 63 e.	13
Birmingham, Ala	25	14	25	12	n. 50 e.	17
Mobile, Ala	30	15	18	9	n. 31 e.	18
Montgomery, Ala	20	13	30	11	n. 70 e.	20
Meridian, Miss	27	16	25	6	n. 60 e.	22
Vicksburg, Miss	24	14	29	10	n. 62 e.	22
New Orleans, La	26	16	29	5	n. 67 e.	26
Western Gulf States.						
Shreveport, La	23	9	29	13	n. 49 e.	21
Bentonville, Ark.†	10	9	10	6	n. 76 e.	4
Fort Smith, Ark	17	6	32	14	n. 59 e.	21
Little Rock, Ark	33	7	19	16	n. 7 e.	26
Corpus Christi, Tex	31	14	20	5	n. 42 e.	23
Fort Worth, Tex	21	14	24	15	n. 52 e.	11
Galveston, Tex	26	16	31	6	n. 68 e.	27
Palestine, Tex	23	17	25	9	n. 69 e.	17
San Antonio, Tex	27	16	27	4	n. 64 e.	26
Taylor, Tex.†	14	6	4	8	n. 27 w.	9
Ohio Valley and Tennessee.						
Chattanooga, Tenn	22	17	16	15	n. 11 e.	5
Knoxville, Tenn	26	13	15	20	n. 21 w.	14
Memphis, Tenn	24	15	27	10	n. 62 e.	19
Nashville, Tenn	21	12	21	20	n. 6 e.	9
Lexington, Ky.†	4	10	12	8	s. 34 e.	7
Louisville, Ky	28	18	13	17	n. 22 w.	11
Evansville, Ind.†	11	6	12	9	n. 31 e.	6
Indianapolis, Ind	20	17	22	18	n. 53 e.	5
Cincinnati, Ohio	18	14	26	18	n. 63 e.	9
Columbus, Ohio	17	18	18	21	s. 72 w.	3
Pittsburg, Pa	27	8	8	29	n. 48 w.	28
Parkersburg, W. Va	17	16	15	22	n. 82 w.	7
Elkins, W. Va	24	10	6	29	n. 59 w.	27
Lower Lake Region.						
Buffalo, N. Y	20	8	13	30	n. 55 w.	21
Canton, N. Y†	9	7	8	16	n. 76 w.	8
Oswego, N. Y	26	16	14	19	n. 27 w.	11
Rochester, N. Y	9	12	12	37	s. 83 w.	25
Syracuse, N. Y	14	12	6	36	n. 86 w.	30
Erie, Pa	15	19	18	23	s. 51 w.	6
Cleveland, Ohio	13	24	18	22	s. 20 w.	12
Sandusky, Ohio†	6	10	5	16	s. 70 w.	12
Toledo, Ohio	16	20	14	23	s. 66 w.	10
Detroit, Mich	19	12	14	27	n. 62 w.	15
Upper Lake Region.						
Alpena, Mich	11	19	15	29	s. 60 w.	16
Escanaba, Mich	20	18	14	22	n. 76 w.	8
Grand Haven, Mich	15	20	22	19	s. 31 e.	6
Grand Rapids, Mich	12	17	20	22	s. 22 w.	5
Houghton, Mich.†	7	7	10	11	w.	1
Marquette, Mich	12	26	12	21	s. 33 w.	17
Port Huron, Mich	19	20	11	27	s. 87 w.	16
Sault Ste. Marie, Mich	13	16	25	20	s. 59 e.	6
Chicago, Ill	10	21	9	30	s. 62 w.	24
Milwaukee, Wis	16	21	8	27	s. 75 w.	20
Green Bay, Wis	14	25	14	21	s. 32 w.	13
Duluth, Minn	16	14	13	30	n. 83 w.	17

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	Hours.	Hours.	Hours.	°	Hours.
North Dakota.						
Moorhead, Minn	19	22	11	22	s. 75 w.	11
Bismarck, N. Dak	26	12	19	23	n. 16 w.	15
Devils Lake, N. Dak	14	19	16	25	s. 61 w.	10
Williston, N. Dak	18	17	10	28	n. 87 w.	18
Upper Mississippi Valley.						
Minneapolis, Minn.*	5	10	7	14	s. 54 w.	9
Madison, Wis	12	29	10	22	s. 35 w.	21
Charles City, Iowa	17	20	18	18	s.	3
St. Paul, Minn	15	22	15	21	s. 41 w.	9
La Crosse, Wis.†	8	12	2	9	s. 60 w.	8
Davenport, Iowa	21	18	15	22	n. 67 w.	8
Des Moines, Iowa	17	21	11	22	s. 70 w.	12
Dubuque, Iowa	16	23	10	25	s. 65 w.	17
Keokuk, Iowa	14	19	17	21	s. 39 w.	6
Cairo, Ill	24	13	25	14	n. 45 e.	16
La Salle, Ill.†	7	7	10	12	w.	2
Peoria, Ill	16	22	14	19	s. 40 w.	8
Springfield, Ill	18	20	15	20	s. 68 w.	5
Hannibal, Mo.†	7	9	8	13	s. 68 w.	5
St. Louis, Mo	17	21	19	16	s. 37 e.	5
Missouri Valley.						
Columbia, Mo.*	8	8	11	10	e.	1
Kansas City, Mo	19	21	18	21	s. 56 w.	4
Springfield, Mo	19	20	23	16	s. 82 e.	7
Iola, Kans.†	13	10	7	10	n. 45 w.	4
Topeka, Kans.*	10	10	7	7	....	0
Lincoln, Nebr	26	22	14	10	n. 45 e.	6
Omaha, Nebr	23	25	8	17	s. 77 w.	9
Valentine, Nebr	25	16	6	29	n. 69 w.	25
Sioux City, Iowa†	12	11	5	8	n. 72 w.	3
Pierre, S. Dak	22	22	20	21	w.	1
Huron, S. Dak	15	21	14	23	s. 56 w.	11
Yankton, S. Dak.†	7	11	6	12	s. 56 w.	7
Northern Slope.						
Havre, Mont	16	11	11	36	n. 79 w.	26
Miles City, Mont	12	27	14	24	s. 34 w.	18
Helena, Mont	13	23	1	40	s. 76 w.	40
Kalispell, Mont	7	12	3	47	s. 84 w.	44
Rapid City, S. Dak	20	8	16	28	n. 45 w.	17
Cheyenne, Wyo	30	12	5	24	n. 47 w.	26
Lander, Wyo	15	20	13	26	s. 69 w.	14
Yellowstone Park, Wyo	13	34	4	24	s. 44 w.	29
North Platte, Nebr	21	18	11	22	n. 75 w.	11
Middle Slope.						
Denver, Colo	23	21	15	12	n. 56 e.	4
Pueblo, Colo	27	9	21	21	n.	18
Concordia, Kans	18	27	10	13	s. 18 w.	10
Dodge, Kans	23	22	16	11	n. 79 e.	5
Wichita, Kans	22	20	17	14	n. 56 e.	4
Oklahoma, Okla	28	22	11	9	n. 18 e.	6
Southern Slope.						
Abilene, Tex	18	26	19	13	s. 37 e.	10
Amarillo, Tex	18	21	18	18	s.	3
Del Rio, Tex†	9	7	16	5	n. 80 e.	11
Roswell, N. Mex	23	20	10	15	n. 59 w.	6
Southern Plateau.						
El Paso, Tex	27	2	25	23	n. 5 e.	25
Santa Fe, N. Mex	24	15	30	9	n. 67 e.	23
Flagstaff, Ariz	23	11	14	25	n. 43 w.	16
Phoenix, Ariz	11	9	26	24	n. 45 e.	3
Yuma, Ariz	33	8	18	12	n. 13 e.	26
Independence, Cal	36	13	7	8	n. 2 w.	23
Middle Plateau.						
Reno, Nev	14	16	18	25	s. 74 w.	7
Tonopah, Nev	14	13	10	36	n. 88 w.	26
Winnemucca, Nev	24	12	20	23	n. 14 w.	12
Modena, Utah	13	12	21	25	n. 76 w.	4
Salt Lake City, Utah	17	20	25	15	s. 73 e.	10
Durango, Colo	23	11	9	33	n. 63 w.	27
Grand Junction, Colo	19	9	17	26	n. 42 w.	14
Northern Plateau.						
Baker City, Oreg	9	35	13	15	s. 4 w.	26
Boise, Idaho	13	27	21	14	s. 27 e.	16
Lewiston, Idaho†	3	7	17	7	s. 68 e.	11
Pocatello, Idaho	9	30	15	23	s. 21 w.	22
Spokane, Wash	22	21	14	13	n. 45 e.	1
Walla Walla, Wash	6	40	7	17	s. 16 w.	35
North Pacific Coast Region.						
North Head, Wash	13	23	28	8	s. 63 e.	22
Port Crescent, Wash.*	3	14	17	3	s. 52 e.	18
Seattle, Wash	17	26	22	6	s. 61 e.	18
Tacoma, Wash	17	30	12	18	s. 25 w.	14
Tatoosh Island, Wash	8	16	33	12	s. 69 e.	22
Portland, Oreg	16	24	16	16	s.	8
Roseburg, Oreg	13	27	19	13	s. 23 e.	15
Middle Pacific Coast Region.						
Eureka, Cal	20	20	20	14	e.	6
Mount Tamalpais, Cal	38	8	6	24	n. 31 w.	35
Red Bluff, Cal	34	11	7	23	n. 35 w.	28
Sacramento, Cal	30	16	15	12	n. 12 e.	14
San Francisco, Cal	26	11	7	32	n. 59 w.	29
San Jose, Cal.†	16	3	3	16	n. 45 w.	18
Southeast Farallon, Cal.*	18	5	1	14	n. 45 w.	18
South Pacific Coast Region.						
Fresno, Cal	32	10	13	18	n. 13 w.	23
Los Angeles, Cal	25	5	17	22	n. 14 w.	21
San Diego, Cal	29	9	18	19	n. 3 w.	20
San Luis Obispo, Cal	35	9	9	18	n. 19 w.	28
West Indies						
San Juan, Porto Rico	9	24	37	1	s. 68 e.	39
Grand Turk, W.I.†	7	9	18	3	s. 82 e.	15

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour, during November, 1906, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3		5	6	7														
Abilene, Tex	23–25			1.01														0.16			
Albany, N. Y	21			0.45														0.23			
Alpena, Mich	9			0.33														0.19			
Amarillo, Tex	17–20			1.46														*			
Anniston, Ala	17–18	9:20 p. m.	D. N.	1.21	12:40 a. m.	1:15 a. m.	0.23	0.07	0.22	0.34	0.47	0.55	0.69	0.86							
Asheville, N. C	17–19			2.13														0.27			
Atlanta, Ga	17–18			0.54														0.14			
Atlantic City, N. J	18–19			0.94														0.45			
Augusta, Ga	14			0.75														0.18			
Baltimore, Md	18–19			0.99														0.36			
Bentonville, Ark	16			0.56														0.53			
Binghamton, N. Y	11			0.44														0.09			
Birmingham, Ala	18–19			1.29														0.39			
Bismarck, N. Dak	25–26			0.55														*			
Block Island, R. I	11			0.83														0.48			
Boise, Idaho	17			0.25														*			
Boston, Mass	15–16			1.15														0.31			
Buffalo, N. Y	20–21			0.72														0.14			
Cairo, Ill	17			3.70														0.40			
Canton, N. Y	25–27			1.00														*			
Charles City, Iowa	25–26			1.16														*			
Charleston, S. C	14			0.38														0.14			
Charlotte, N. C	17–18			0.51														0.28			
Chattanooga, Tenn	17–19			2.00														0.52			
Cheyenne, Wyo	1–2			0.72														*			
Chicago, Ill	19–21			1.78														*			
Cincinnati, Ohio	19–20			1.36														0.41			
Cleveland, Ohio	20–21			0.68														0.27			
Columbia, Mo	16			0.29														0.25			
Columbia, S. C	11			0.30														0.27			
Columbus, Ohio	20			1.48														0.46			
Concord, N. H	11–12			1.20														0.07			
Corpus Christi, Tex	23–24			4.14														0.76			
Davenport, Iowa	25–26			1.32														0.23			
Del Rio, Tex	30			0.20														0.09			
Denver, Colo	1–2			0.99														*			
Des Moines, Iowa	25			1.10														*			
Detroit, Mich	20–21			1.29														0.21			
Dodge, Kans	30			0.64														*			
Dubuque, Iowa	25–26			1.07														*			
Duluth, Minn	16–17			0.67														*			
Eastport, Me	1–2			1.86														0.15			
Elkins, W. Va	19–20			0.67														0.27			
Erie, Pa	20–21			0.88														0.19			
Escanaba, Mich	25–26			1.88														*			
Evansville, Ind	17–18			2.34														0.33			
Fort Smith, Ark	19–20			1.27														0.28			
Fort Worth, Tex	23–24			1.77														0.29			
Galveston, Tex	19			0.14														0.13			
Grand Haven, Mich	21			0.68														0.26			
Grand Rapids, Mich	20–21			1.22														0.23			
Green Bay, Wis	21			1.84														*			
Hannibal, Mo	20–21			1.37														*			
Harrisburg, Pa	18–19			0.31														0.08			
Hartford, Conn	11			1.50														*			
Hatteras, N. C	14–15			1.06														0.48			
Huron, S. Dak	16–17			0.20														*			
Indianapolis, Ind	20			1.49														0.31			
Iola, Kans	30			1.52														0.28			
Jacksonville, Fla	14–15			0.01														0.01			
Jupiter, Fla	1	12:30 a. m.	4:40 p. m.	3.16	4:57 a. m.	6:17 a. m.	0.50	0.12	0.35	0.65	0.81	0.90	1.01	1.10	1.17	1.22	1.25	1.38	1.77		
Kansas City, Mo	25–26			0.95														0.20			
Key West, Fla	2–3	7:15 p. m.	8:45 p. m.	5.96	9:58 p. m.	10:48 p. m.	1.14	0.19	0.40	0.57	0.81	0.95	1.07	1.09	1.11	1.15	1.18				
					10:48 p. m.	11:52 p. m.		1.20	1.29	1.47	1.66	1.99	2.20	2.29	2.35	2.43	2.52	2.83			
Knoxville, Tenn	18–19			2.66														0.46			
La Crosse, Wis	25–26			0.96														0.14			
La Salle, Ill	20–21			1.07														0.27			
Lexington, Ky	19			2.32														0.40			
Lincoln, Nebr	25			0.07														*			
Little Rock, Ark	16–17			2.13														0.42			
Los Angeles, Cal	22			0.54														0.26			
Louisville, Ky	19–20	1:35 p. m.	2:55 a. m.	3.02	1:04 a. m.	2:19 a. m.	1.33	0.07	0.11	0.16	0.22	0.26	0.36	0.47	0.53	0.62	0.77	0.98	1.58		
Lynchburg, Va	18–19	7:20 p. m.	8:05 a. m.	1.73	12:15 a. m.	12:40 a. m.	0.46	0.07	0.19	0.37	0.53	0.64									
Macon, Ga	14			0.83														0.30			
Madison, Wis	21			1.17														0.19			
Marquette, Mich	25–26			1.54														*			
Memphis, Tenn	16–18	9:45 p. m.	4:33 a. m.	6.59	4:17 a. m. †	4:58 a. m. †	1.45	0.16	0.30	0.51	0.64	0.78	0.81	0.94	1.00	1.04					
	19–20	11:48 a. m.	D. N.	3.52	5:00 p. m.	5:42 p. m.	1.14	0.13	0.16	0.35	0.46	0.60	0.88	1.20	1.34	1.39					
	20–21	7:00 a. m.	8:45 a. m.	3.83	2:03 a. m.	2:49 a. m.	1.59	0.09	0.14	0.18	0.22	0.25	0.45	0.53	0.73	0.88	0.91				
Meridian, Miss	18–19			1.23														0.59			
Milwaukee, Wis	20–21			1.45														0.50			
Minneapolis, Minn	6–7			1.08														0.33			
Montgomery, Ala	14			0.97														0.39			
Mount Weather, Va	18–19			0.84														*			
Nantucket, Mass	11			0.25														0.24			
Nashville, Tenn	17–18			4.11														0.56			
New Haven, Conn	11–12			1.38														0.34			
New Orleans, La	14	11:55 a. m.	2:20 p. m.	0.78	12:19 p. m.	12:36 p. m.	0.04	0.15	0.30	0.49	0.52										
New York, N. Y	15–16			0.57														0.13			
Norfolk, Va	14–15			0.58														0.15			
Northfield, Vt	15–16			0.86														*			
North Head, Wash	3–4			1.46														0.35			
Oklahoma, Okla	28–29			0.51														0.16			
Omaha, Nebr	25–26			0.23														*			
Palestine, Tex	7	4:45 p. m.	5:45 p. m.	0.51	5:06 p. m.	5:20 p. m.	0.02	0.08	0.30	0.47											
Parkersburg, W. Va	19			0.87														0.26			
Pensacola, Fla	14			0.50														0.35			
Peoria, Ill	19–21			1.26														*			
Philadelphia, Pa	18–19			0.72														0.55			
Pittsburg, Pa	17–18			0.33														*			

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Portland, Me	15-16			1.11														0.25			
Portland, Oreg	7-8			2.49														0.31			
Pueblo, Colo	18			0.18														*			
Raleigh, N. C	14-15			0.58														0.13			
Richmond, Va	19			0.23														0.15			
Rochester, N. Y	21			0.47														0.18			
Sacramento, Cal	4	D. N.	7:20 a. m.	0.75	5:36 a. m.	5:46 a. m.	0.24	0.22	0.30												
St. Louis, Mo	16-17			1.44														0.45			
St. Paul, Minn	6			0.55														0.24			
Salt Lake City, Utah	25			0.54														*			
San Antonio, Tex	25-26	8:10 p. m.	1:15 a. m.	0.53	10:10 p. m.	10:22 p. m.	0.03	0.08	0.23	0.35											
San Diego, Cal	29			0.21														0.15			
Sandusky, Ohio	19-20			0.85														*			
San Francisco, Cal	4			0.67														0.30			
Savannah, Ga	14			0.36														0.16			
Scranton, Pa	15			1.20														0.18			
Seattle, Wash	14-15			2.40														0.33			
Shreveport, La	19			0.45														0.38			
Spokane, Wash	6-7			0.74														0.10			
Springfield, Ill	19-21			2.48														*			
Springfield, Mo	16	6:10 p. m.	8:10 p. m.	0.71	6:19 p. m.	6:34 p. m.	0.03	0.21	0.42	0.54											
Syracuse, N. Y	11			0.97														*			
Tampa, Fla	15			0.30														0.13			
Taylor, Tex	25-26			0.46														0.33			
Thomasville, Ga	14			0.59														0.44			
Toledo, Ohio	20			1.51														0.32			
Topeka, Kans	25			1.08														0.19			
Valentine, Nebr	1-2			0.32														*			
Vicksburg, Miss	17-18	11:15 p. m.	7:03 a. m.	1.60	†11:31 p. m. 12:17 a. m.	11:41 p. m. 12:30 a. m.	0.02 0.43	0.17 0.20	0.32 0.31	 0.39											
Washington, D. C	18-19			0.90														0.22			
Wichita, Kans	30			0.92														0.26			
Wilmington, N. C	11-12	6:34 p. m.	D. N.	0.72	6:36 p. m.	6:53 p. m.	T.	0.26	0.37	0.43											
Wytheville, Va	11			0.96														0.25			
Yankton, S. Dak	16			0.21														*			
San Juan, Porto Rico	25	7:00 p. m.	8:20 p. m.	0.76	7:38 p. m.	8:10 p. m.	0.07	0.16	0.35	0.42	0.47	0.55	0.64	0.68							

*Self-register not working †Of the 17th.

TABLE V.—*Data furnished by the Canadian Meteorological Service, November, 1906.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure. Sea level, reduced to mean of 24 hours.	Pressure. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Total snowfall.
	Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.
St. Johns, N. F										
Sydney, C. B. I	29.79	29.83	—.12	38.8	+ 1.7	43.9	33.6	7.62	+2.18	T.
Halifax, N. S	29.75	29.86	—.15	39.1	+ 1.8	43.7	34.5	5.92	+0.26	6.1
Grand Manan, N. B	29.82	29.87	—.14	38.4	— 0.5	43.1	33.8	5.91	+0.29	T.
Yarmouth, N. S	29.82	29.89	—.13	39.7	— 0.2	43.9	35.6	4.45	—0.11	1.4
Charlottetown, P. E. I	29.81	29.85	—.11	36.7	+ 1.2	39.8	33.6	8.00	+4.03	11.3
Chatham, N. B	29.88	29.90	—.07	33.1	+ 2.1	37.3	28.9	4.52	+0.77	26.2
Father Point, Que	29.98	30.00	+.04	29.6	+ 3.7	34.5	24.7	3.07	—0.04	30.7
Quebec, Que	29.69	30.03	+.01	29.8	+ 0.8	34.7	25.0	2.34	—1.42	15.6
Montreal, Que	29.84	30.06	+.03	32.6	+ 0.8	37.8	27.5	2.92	—0.82	22.4
Rockliffe, Ont	29.48	30.11	+.10	29.6	+ 0.5	36.9	22.4	1.55	—1.03	12.1
Ottawa, Ont	29.78	30.07	+.05	32.3	+ 0.6	37.8	26.8	1.48	—1.06	6.5
Kingston, Ont	29.78	30.10	+.06	35.7	+ 0.7	42.4	28.9	2.39	—0.85	4.6
Toronto, Ont	29.73	30.12	+.08	37.4	+ 1.8	43.6	31.2	1.70	—1.44	0.8
White River, Ont	28.81	30.17	+.19	27.2	+ 6.7	34.4	19.9	2.24	+0.39	12.3
Port Stanley, Ont	29.49	30.15	+.10	37.8	+ 1.0	45.2	30.3	2.32	—1.05	1.4
Saugeen, Ont	29.40	30.13	+.12	36.3	+ 1.3	43.0	29.6	3.63	—0.07	2.6
Parry Sound, Ont	29.40	30.12	+.11	33.3	+ 1.2	40.9	25.7	4.22	-0.15	8.0
Port Arthur, Ont	29.37	30.10	+.10	32.0	+ 8.0	38.4	25.5	4.29	+2.96	0.8
Winnipeg, Man	29.21	30.08	+.04	26.0	+ 8.0	33.1	19.0	1.87	+0.79	14.8
Minnedosa, Man	28.16	30.04	.00	25.3	+ 8.0	32.5	18.1	2.37	+1.37	23.7
Qu'Appelle, Sask	27.70	30.02	+.02	23.4	+ 4.6	29.4	17.5	2.51	+1.62	18.3
Medicine Hat, Alberta	27.66	29.99	—.01	28.9	+ 1.5	37.5	20.3	1.04	+0.12	4.0
Swift Current, Sask	27.44	30.10	+.08	24.8	+ 1.6	31.8	17.8	1.94	+1.25	15.9
Calgary, Alberta	26.39	30.04	+.06	26.9	+ 1.1	35.9	17.9	0.34	—0.54	3.4
Banff, Alberta	25.35	30.11	+.15	22.7		30.2	15.2	0.87	—1.40	5.7
Edmonton, Alberta										
Prince Albert, Sask	28.42	30.03	.00	22.9	+ 7.5	28.3	17.5	1.66	+0.83	14.1
Battleford, Sask	28.23	30.03	+.01	22.3	+ 6.0	28.2	16.5	0.42	—0.16	3.8
Kamloops, B. C	28.79	30.04	+.08	35.4	+ 2.0	40.8	30.1	2.38	+0.92	18.0
Victoria, B. C	29.95	30.05	+.06	44.2	+ 1.0	48.4	40.0	6.13	—0.84	
Barkerville, B. C	25.59	29.97	+.07	26.1	— 2.5	31.7	20.5	3.46	+0.17	33.0
Hamilton, Bermuda	29.92	30.08	+.03	68.8	+ 0.1	73.5	64.2	4.96	+0.58	
Dawson, Yukon										

TABLE VI.—*Heights of rivers referred to zeros of gages, November, 1906.*

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Milk River.								
Havre, Mont. (15)	237	9	2.8	15	2.2	1-11	2.3	0.6
James River.								
Huron, S. Dak. (13)	139	9	1.0	13, 17	0.7	3, 4	0.8	0.3
Republican River.								
Clay Center, Kans	42	18	6.2	13-15, 26	6.0	2-7, 18-21	6.1	0.2
Smoky Hill-Kansas River.								
Abilene, Kans	277	22	1.7	1	0.4	21, 23-25, 28	0.8	1.3
Manhattan, Kans	116	18	3.3	3, 4, 27-30	3.0	1, 24	3.2	0.3
Topeka, Kans	87	21	6.6	24	5.9	1	6.3	0.7
Missouri River.								
Bismarck, N. Dak	1,309	14	1.8	19, 26, 27	0.3	5	1.0	1.5
Pierre, S. Dak	1,114	14	1.4	1	—1.9	20	—0.2	3.3
Sioux City, Iowa	784	17	7.7	1	4.0	23	5.9	3.7
Missouri River—Cont'd.								
Blair, Nebr	705	15	6.6	1	4.6	27	5.7	2.0
Omaha, Nebr	669	18	7.0	4	4.7	30	5.8	2.3
St. Joseph, Mo	481	10	3.2	1, 5	0.4	25	2.1	2.8
Kansas City, Mo	388	21	9.2	1-4	6.5	30	8.6	2.7
Glasgow, Mo	231	18	7.0	2	4.7	30	6.2	2.3
Boonville, Mo	199	20	11.2	1	9.0	30	10.4	2.2
Hermann, Mo	103	24	8.2	3	7.2	30	7.7	1.0
Minnesota River.								
Mankato, Minn	127	18	6.5	1, 8, 9	4.7	25	5.7	1.8
St. Croix River.								
Stillwater, Minn. (12)	23	11	8.7	1-3	7.7	17, 18	8.2	1.0
Red Cedar River.								
Cedar Rapids, Iowa	77	14	4.1	30	3.4	10, 24	3.6	0.7

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Des Moines River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Des Moines, Iowa	205	19	4.5	1	3.6	23–26	3.8	0.9
Illinois River.								
La Salle, Ill	197	18	15.6	26, 27	11.7	12	12.8	3.9
Peoria, Ill.	135	14	10.6	30	7.9	17	8.6	2.7
Clarion River.								
Clarion, Pa.	32	10	3.7	22	0.8	15	1.9	2.9
Conemaugh River.								
Johnstown, Pa.	64	7	3.4	19	0.7	7–10	1.4	2.7
Allegheny River								
Warren, Pa	177	14	4.4	21–23	1.5	17, 18	2.6	2.9
Franklin, Pa	114	15	6.3	22	2.0	11	3.6	4.3
Parker, Pa.	73	20	6.3	22	1.7	11	3.3	4.6
Freeport, Pa.	29	20	10.7	23	3.1	12, 13	5.8	7.6
Springdale, Pa.	17	27	13.6	22	7.9	12	9.8	5.7
Cheat River.								
Rowlesburg, W. Va.	36	14	6.9	20	1.4	11, 12	2.6	5.5
Youghiogheny River.								
Confluence, Pa.	59	10	2.8	21	0.0	5–13	0.6	2.8
West Newton, Pa.	15	23	3.9	21	0.0	9–18	0.8	3.9
Monongahela River.								
Weston, W. Va.	161	18	2.2	20	− 1.8	10–17	0.8	4.0
Fairmont, W. Va.	119	25	22.7	20	14.3	1	15.2	8.4
Greensboro, Pa	81	18	16.5	20	6.8	10–18	7.9	9.7
Lock No. 4, Pa.	40	28	20.0	21	6.9	9–15	8.3	13.1
Beaver River.								
Ellwood Junction, Pa.	10	14	4.6	19	1.5	17	2.8	3.1
Muskingum River.								
Zanesville, Ohio	70	25	14.6	22	8.3	7–16	9.5	6.3
Beverly, Ohio	20	25	11.9	22	5.7	11–17	7.0	6.2
Little Kanawha River.								
Glenville, W. Va	77	20	12.0	20	0.0	11	1.7	12.0
Creston, W. Va.	38	20	13.0	20	− 3.0	4	3.0	16.0
New-Great Kanawha River.								
Radford, Va	213	14	7.4	20	1.0	9, 10	2.3	6.4
Hinton, W. Va.	153	14	12.1	20	2.4	8–10	3.4	9.7
Charleston, W. Va.	58	30	24.2	21	4.7	2	8.1	19.5
Scioto River.								
Columbus, Ohio	110	17	9.3	21	2.3	8	3.5	7.0
Licking River.								
Falmouth, Ky.	30	25	18.8	21	1.0	9–15	3.4	17.8
Miami River.								
Dayton, Ohio	77	18	4.2	21	0.8	1–3	2.5	3.4
Kentucky River.								
Jackson, Ky	287	24	18.0	20	4.8	10–12	6.0	13.2
Beattyville, Ky	254	30	15.5	20	0.1	10, 11	1.6	15.4
High Bridge, Ky	117	17	16.7	22	9.1	2	10.7	7.6
Frankfort, Ky.	65	31	12.5	22	5.5	15, 17, 18	6.9	7.0
Wabash River.								
Mount Carmel, Ill.	75	15	13.2	26	1.0	5–17	4.1	12.2
Cumberland River.								
Burnside, Ky.	518	50	31.6	20	0.3	17	5.2	31.3
Celina, Tenn.	383	45	28.4	22	1.7	9, 10	7.9	26.7
Carthage, Tenn.	308	40	24.7	23	1.8	9–11	7.4	22.9
Nashville, Tenn	193	40	28.1	24	7.9	10–14	14.2	20.2
Clarksville, Tenn.	126	42	43.5	20	3.0	12, 14, 15	16.1	40.5
Powell River.								
Tazewell, Tenn.	44	20	20.5	20	0.2	1–11	2.4	20.3
Clinch River.								
Speers Ferry, Va.	156	20	20.0	19	− 0.2	10	2.2	20.2
Clinton, Tenn	52	25	31.0	21	3.2	7–9	7.7	27.8
South Fork Holston River.								
Bluff City, Tenn.	35	15	5.8	20	0.9	7–10	1.8	4.9
Holston River.								
Rogersville, Tenn.	103	14	13.5	20	1.7	9, 10	3.2	11.8
French Broad River.								
Asheville, N. C.	144	6	5.0	19	0.1	14–17	1.1	4.9
Little Tennessee River.								
McGhee, Tenn.	17	20	30.0	19	3.5	10, 14–17	5.7	26.5
Hiwassee River.								
Charleston, Tenn	18	22	30.0	20	1.8	8, 10	5.3	28.2
Tennessee River.								
Knoxville, Tenn.	635	12	23.0	20	1.7	9–11	4.5	21.3
Loudon, Tenn	590	25	27.0	20	2.1	11, 12	5.3	24.9
Kingston, Tenn	556	25	22.6	21	2.0	12–15	5.4	20.6
Chattanooga, Tenn.	452	33	33.3	22	3.5	11–13	9.1	29.8
Bridgeport, Ala	402	24	23.4	23	2.0	11–13	6.5	21.4
Guntersville, Ala.	349	31	29.8	24	4.2	13	10.5	25.6
Florence, Ala.	255	16	16.7	26	1.7	13–15	5.9	15.0
Riverton, Ala.	225	26	27.2	26	3.8	12–15	10.2	23.4
Johnsonville, Tenn.	95	21	24.8	28	3.3	14	12.0	21.5
Ohio River.								
Pittsburg, Pa.	966	22	12.4	21	3.0	30	6.2	9.4
Davis Island Dam, Pa.	960	25	13.2	21	3.7	13	6.4	9.5
Beaver Dam, Pa	925	27	18.0	22	5.0	13	8.3	13.0
Wheeling, W. Va.	875	36	18.0	22	4.5	12	7.9	13.5
Parkersburg, W. Va.	785	36	18.8	23	5.3	15, 16	8.7	13.5
Point Pleasant, W. Va.	703	39	25.0	21	4.1	15–17	9.8	20.9
Huntington, W. Va	660	50	30.4	21	7.0	13	13.4	23.4
Catlettsburg, Ky.	651	50	31.4	21	5.5	13	12.9	25.9
Portsmouth, Ohio	612	50	32.1	22	6.6	14	13.8	25.5
Maysville, Ky.	559	50	30.7	22	6.5	15	14.0	24.2
Cincinnati, Ohio	499	50	33.7	22	8.2	16	15.8	25.5
Madison, Ind	413	46	28.5	23	7.3	16, 17	13.7	21.2
Louisville, Ky	367	28	11.3	23, 24	3.4	17	6.1	7.9
Evansville, Ind	184	35	31.3	25	6.0	17	14.1	25.3
Mount Vernon, Ind	148	35	30.0	26	5.2	19	12.6	24.8
Paducah, Ky.	47	40	32.8	27	5.3	17	15.3	27.5
Cairo, Ill.	1	45	36.3	27, 28	12.0	12, 15–17	20.3	24.3
St. Francis River.								
Marked Tree, Ark.	104	17	16.5	30	8.6	7–10	11.1	7.9
Neosho River.								
Neosho Rapids, Kans.	326	22	1.2	30	0.8	19	1.0	0.4
Neosho River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Iola, Kans	262	10	1.2	27	0.0	1–4	0.3	1.2
Oswego, Kans.	184	20	1.1	30	0.0	1–7	0.1	1.1
Fort Gibson, Ind. T	3	22	10.1	2	9.5	5, 6, 10, 11, 17–23	9.6	0.6
Canadian River.								
Calvin, Ind. T	99	10	2.7	30	2.1	12, 13, 17-21	2.3	0.6
Black River.								
Blackrock, Ark.	67	12	20.8	22	3.0	15, 16	9.3	17.8
White River.								
Calicorock, Ark	272	15	6.0	22	0.4	12-16	1.9	5.6
Batesville, Ark.	217	18	9.2	22	2.3	16	4.3	6.9
Newport, Ark.	185	26	18.5	24–26	2.5	16, 17	8.3	16.0
Clarendon, Ark.	75	30	25.9	30	11.6	16	18.2	14.3
Arkansas River.								
Wichita, Kans.	832	10	0.7	23	0.0	8, 9	0.3	0.7
Tulsa, Ind. T.	551	16	3.6	1–3	3.1	19-22, 26, 27	3.3	0.5
Webbers Falls, Ind. T.	465	23	3.4	20–23	3.0	25–30	3.3	0.4
Fort Smith, Ark.	403	22	3.6	23	2.3	14–21	2.7	1.3
Dardanelle, Ark.	256	21	3.3	22	1.9	16	2.6	1.4
Little Rock, Ark.	176	23	6.8	25	3.1	15, 16	4.4	3.7
Pine Bluff, Ark.	121	23	9.5	24	5.1	16	6.5	4.4
Yazoo River.								
Greenwood, Miss	175	38	25.3	30	3.0	17	11.4	22.3
Yazoo City, Miss.	80	25	16.5	30	− 0.3	17	6.8	16.8
Ouachita River.								
Monroe, La	122	40	22.4	30	2.0	16–18	8.5	20.4
Red River								
Denison, Tex.	768	22	2.2	1	1.3	24, 28	1.6	0.9
Arthur City, Tex.	688	27	8.0	1, 2	6.7	30	7.1	1.3
Fulton, Ark.	515	28	9.8	1	8.2	16, 17	8.9	1.6
Shreveport, La.	327	29	3.6	1	0.4	17, 19	1.6	3.2
Alexandria, La.	118	33	10.0	23	2.9	19, 20	5.3	7.1
Mississippi River.								
Fort Ripley, Minn.	2,082	10	10.1	25	5.3	20, 21	6.9	4.8
St. Paul, Minn.	1,954	14	7.9	2, 3	5.0	25	6.8	2.9
Red Wing, Minn (9)	1,914	14	6.1	3, 4	5.3	19–21	5.7	0.8
Reeds Landing, Minn	1,884	12	5.7	2–5	4.0	25	5.1	1.7
La Crosse, Wis.	1,819	12	6.6	5–9	5.4	27–29	6.2	1.2
Prairie du Chien, Wis.	1,759	18	7.5	8–12	6.3	1	7.1	1.2
Dubuque, Iowa	1,699	18	7.4	11, 12	5.7	1	7.1	1.7
Clinton, Iowa	1,629	16	6.9	27, 28	5.0	1	6.4	1.9
Leclaire, Iowa	1,609	10	4.8	28	2.9	1	4.3	1.9
Davenport, Iowa	1,593	15	6.4	28, 29	4.4	1	5.6	2.0
Muscatine, Iowa	1,562	16	7.5	28–30	5.2	1	6.5	2.3
Galland, Iowa	1,472	8	3.6	29, 30	1.8	1	2.9	1.8
Keokuk, Iowa.	1,463	15	5.8	29, 30	3.5	1	4.9	2.3
Warsaw, Ill.	1,458	18	8.8	30	6.0	1	7.8	2.8
Hannibal, Mo	1,402	13	6.4	30	4.2	1	5.6	2.2
Grafton, Ill	1,306	23	8.0	23	5.8	1, 2	7.1	2.2
St. Louis, Mo	1,264	30	9.6	22, 23	6.1	1	8.4	3.5
Chester, Ill	1,189	30	10.2	22	5.0	1	7.4	5.2
New Madrid, Mo.	1,003	34	29.4	28	10.1	12, 13, 16, 17	16.4	19.3
Luxora, Ark	905	33	24.5	29, 30	3.5	15, 16	9.8	21.0
Memphis, Tenn	843	33	29.3	30	6.7	14–16	13.5	22.6
Helena, Ark.	767	42	36.9	30	9.9	15, 16	17.7	27.0
Arkansas City, Ark.	635	42	37.7	30	12.1	17	19.7	25.6
Greenville, Miss.	595	42	32.0	30	9.5	17	15.8	22.5
Vicksburg, Miss.	474	45	33.5	30	9.1	17	15.7	24.4
Natchez, Miss.	373	46	31.5	30	11.7	19	16.7	19.8
Baton Rouge, La.	240	35	21.7	30	7.3	17, 22	10.3	14.4
Donaldsonville, La	188	28	16.4	30	5.4	15, 16, 22	7.7	11.0
New Orleans, La.	108	16	10.5	30	4.5	15	5.9	6.0
Atchafalaya River.								
Simmesport, La.	127	33	24.9	30	6.6	17, 19	11.9	18.3
Melville, La.	103	31	27.1	30	11.0	17–21	15.7	16.1
Morgan City, La	19	8	5.0	17–21	2.5	12, 28	3.8	2.5
Grand River.								
Grand Rapids, Mich.	38	11	3.0	24–28	1.6	16	2.2	1.4
Sandusky River.								
Tiffin, Ohio	65	8	3.2	22	0.5	7–10	1.0	2.7
Penobscot River.								
Mattawamkeag, Me. (a)	87	......	12.4	4	11.0	28	11.7	1.4
West Enfield, Me.	60	......	6.1	4	4.0	28, 29	5.1	2.1
Kennebec River.								
Winslow, Me	46	8	5.5	21–23	4.0	3	4.8	1.5
Merrimac River.								
Franklin Junction, N. H.	110	13	5.0	22	4.0	18	4.4	1.0
Manchester. N. H	68	8	4.0	25	1.8	10	3.0	2.2
Connecticut River.								
Wells River, Vt. (a)	255	34	24.8	1	23.2	26, 27	23.8	1.6
Whiteriver Junction, Vt.	209	......	6.5	22, 23	4.2	11	5.4	2.3
Bellows Falls, Vt	170	12	3.7	25	1.7	9	2.5	2.0
Holyoke, Mass	84	9	4.4	25	− 0.5	10	2.6	4.9
Hartford, Conn.	50	16	5.4	22	2.0	4	3.2	3.4
Housatonic River.								
Gaylordsville, Conn.	44	15	4.9	21	3.4	6	4.1	1.5
Mohawk River.								
Utica, N. Y.	98	6	6.9	19	0.5	7, 8	2.8	6.4
Tribeshill, N. Y	42	12	4.0	20	0.0	9, 10	1.2	4.0
Schenectady, N. Y.	19	15	6.0	21	1.2	4–8	2.1	4.8
Hudson River.								
Glens Falls, N. Y	197	20	4.7	23, 24	3.3	5, 8, 11–14	3.8	1.4
Troy, N. Y.	154	14	5.0	25	2.7	1	3.4	2.3
Albany, N. Y	147	12	5.7	20	1.4	11	3.1	4.3
Pompton River.								
Pompton Plains, N. J	6	8	4.0	1, 2, 18–24, 26–30	3.7	7–11	3.9	0.3
Passaic River.								
Chatham, N. J	69	7	3.2	19, 20	2.3	9-11, 15, 30	2.6	0.9
Lehigh River.								
Mauch Chunk, Pa	45	15	5.5	20	4.6	17, 18	4.9	0.9
Schuylkill River.								
Reading, Pa.	66	12	1.0	1	0.3	18	0.6	0.7

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Delaware River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Hancock (E. Branch), N. Y.	269	12	6.1	19	3.3	9, 11, 15, 16, 18	4.0	2.8
Hancock (W. Branch), N. Y.	269	10	6.3	19	3.1	11, 17	4.0	3.2
Port Jervis, N. Y.	204	14	4.9	20	0.8	10, 11	1.8	4.1
Phillipsburg, N. J.	142	26	5.9	21	1.8	11, 12	3.0	4.1
Trenton, N. J.	92	18	4.6	22	1.2	1, 2	2.1	3.4
North Branch Susquehanna.								
Binghamton, N. Y.	183	16	6.2	20	2.2	11	3.2	4.0
Towanda, Pa.	139	16	5.1	22	1.6	12	2.7	3.5
Wilkes-Barre, Pa.	60	17	9.4	21	3.9	11	5.7	5.5
West Branch Susquehanna.								
Renovo, Pa.	90	16	3.2	23	1.0	10-16	1.7	2.2
Williamsport, Pa.	39	20	4.0	23	1.6	10, 18	2.4	2.4
Juniata River.								
Huntingdon, Pa.	90	24	3.2	1, 2, 20, 21	3.0	3, 5-18, 22-30	3.0	0.2
Susquehanna River.								
Harrisburg, Pa.	69	17	4.2	22-24	1.9	13, 14	2.7	2.3
Shenandoah River.								
Riverton, Va.	58	22	−0.5	1-30	−0.5	1-30	−0.5	0.0
Potomac River.								
Cumberland, Md.	290	8	4.0	21-25	2.9	29, 30	3.5	1.1
Harpers Ferry, W. Va.	172	18	6.0	22	0.7	18	1.9	5.3
James River.								
Buchanan, Va.	305	12	7.4	21	2.7	10, 11, 15-18	3.5	4.7
Lynchburg, Va.	260	18	7.3	21	1.0	17, 18	2.2	6.3
Columbia, Va.	167	18	13.7	21	4.1	10	6.2	9.6
Richmond, Va.	111	12	5.8	22	0.3	11, 18, 25	1.2	5.5
Dan River.								
Danville, Va.	55	8	2.5	20	−0.1	8-10	0.2	2.6
Staunton River.								
Randolph, Va.	26	28	14.7	20	5.2	9-11, 15, 27	6.1	9.5
Roanoke River.								
Clarksville, Va.	196	12	2.4	22	0.2	13-15, 29, 30	0.8	2.2
Weldon, N. C.	129	30	20.1	22	10.7	20	11.6	9.4
Tar River.								
Tarboro, N. C.	46	25	3.8	18	2.4	12	2.0	1.4
Greenville, N. C.	21	22	5.2	20, 21	3.5	27-30	4.2	1.7
Haw River.								
Moncure, N. C.	171	25	8.5	18	8.2	4, 5, 30	8.3	0.3
Cape Fear River.								
Fayetteville, N. C.	112	38	4.8	16	3.0	30	3.1	1.8
Waccamaw River.								
Conway, S. C.	40	7	3.6	1	1.4	28, 29	2.5	2.2
Pedee River.								
Cheraw, S. C.	149	27	17.4	23	2.9	13, 14	4.5	14.5
Smiths Mills, S. C.	51	16	13.3	1	5.5	17-19	8.1	7.8
Lynch Creek.								
Effingham, S. C.	35	12	6.6	1	3.2	29, 30	4.3	3.4
Black River.								
Kingstree, S. C.	45	12	9.0	1	5.0	15, 19-24	6.0	4.0
Catawba-Wateree River.								
Mount Holly, N. C.	143	15	9.4	20	1.8	9-15	2.3	7.6
Catawba, S. C.	107	11	7.9	21	2.4	9, 10	3.2	5.5
Camden, S. C.	54	24	21.5	21	7.1	19	9.1	14.4
Broad River.								
Blairs, S. C.	36	14	2.5	17	1.0	13	1.7	1.5
Saluda River.								
Pelzer, S. C.	109	7	4.0	20-23	3.0	5, 6, 11	3.6	1.0
Chappels, S. C.	56	14	4.0	16, 22	1.9	15	3.1	2.1
Congaree River.								
Columbia, S. C.	52	15	2.4	21	0.8	11	1.3	1.6
Santee River.								
Rimini, S. C.	108	12	11.3	23, 24	7.0	15	9.3	4.3
St. Stephens, S. C.	50	10	9.6	1	6.2	14-17	7.6	3.4
Edisto River.								
Edisto, S. C.	75	6	3.4	21-27	2.0	6	2.8	1.4
Broad River.								
Carlton, Ga.	30	11	3.1	19, 20	2.5	4-14, 28-30	2.6	0.6
Savannah River.								
Calhoun Falls, S. C.	347	15	7.9	19	2.7	16, 17, 30	3.3	5.2
Augusta, Ga.	268	32	14.0	20	8.8	7, 8	9.7	5.2
Oconee River.								
Milledgeville, Ga.	147	25	4.7	22	2.1	28	3.2	2.6
Dublin, Ga.	79	30	2.8	22	0.2	3, 4, 29	1.1	2.6
Ocmulgee River.								
Macon, Ga.	203	18	5.5	19	2.7	11	3.3	2.8
Abbeville, Ga.	96	11	5.6	24	2.6	4, 15	3.5	3.0
Flint River.								
Woodbury, Ga.	227	10	2.4	19	0.5	9, 14	0.9	1.9
Montezuma, Ga.	152	20	6.6	22	2.7	8-10	4.0	3.9
Albany, Ga.	90	20	4.3	23	1.5	14	2.4	2.8
Bainbridge, Ga.	29	22	5.6	24	3.7	13-16	4.4	1.9

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Chattahoochee River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Oakdale, Ga.	305	18	6.0	19	3.5	8, 9	4.4	2.5
West Point, Ga.	239	20	5.6	21	3.3	11-14	3.7	2.3
Eufaula, Ala.	90	40	4.5	20, 22	2.2	14	3.3	2.3
Alaga, Ala.	30	25	14.1	20, 21	5.1	14	7.2	9.0
Coosa River.								
Rome, Ga.	266	30	23.6	20	1.6	10-17	6.9	22.0
Gadsden, Ala.	162	22	19.8	22	2.4	11-14	7.6	17.4
Lock No. 4, Ala.	113	17	14.9	22, 23	1.9	13, 14	6.0	13.0
Wetumpka, Ala.	12	45	24.8	22	4.9	14	11.4	19.9
Tallapoosa River.								
Milstead, Ala.	42	35	17.0	20	2.7	7-14	4.6	14.3
Alabama River.								
Montgomery, Ala.	323	35	21.3	22, 23	2.9	14	8.8	18.4
Selma, Ala.	246	35	23.3	24	3.4	14	9.9	19.9
Black Warrior River.								
Tuscaloosa, Ala.	90	43	19.1	21	5.6	12-14	8.0	13.5
Tombigbee River.								
Columbus, Miss.	316	33	7.0	23	−2.3	15-17	0.6	9.3
Vienna, Ala.	246	42	10.3	24	0.5	13, 14	3.5	9.8
Demopolis, Ala.	168	35	16.3	24	0.5	14, 15	4.9	15.8
Leaf River.								
Hattiesburg, Miss.	60	20	4.2	21	2.8	8, 9, 13	3.3	1.4
Chickasawhay River.								
Enterprise, Miss.	144	18	6.9	21	1.4	12-14	2.3	5.5
Shubuta, Miss.	166	25	3.4	1-3	2.8	13-30	3.0	0.6
Pascagoula River.								
Merrill, Miss.	78	20	5.5	25, 26	2.6	14	3.6	2.9
Pearl River.								
Jackson, Miss.	242	20	3.8	26, 27	1.8	17	2.6	2.0
Columbia, Miss.	110	14	5.5	1	4.0	14	4.5	1.5
Sabine River.								
Logansport, La.	315	25	4.5	30	2.2	17	3.3	2.3
Neches River.								
Rockland, Tex.	105	20	2.0	1-3	0.0	15-30	0.7	2.0
Beaumont, Tex.	18	10	1.7	20	0.6	28, 29	1.1	1.1
Trinity River.								
Dallas, Tex.	320	25	6.4	27	4.1	12-18	4.6	2.3
Long Lake, Tex.	211	35	14.2	30	3.2	20	4.9	11.0
Riverside, Tex.	112	40	4.5	30	0.6	22, 23	1.2	3.9
Liberty, Tex.	20	25	5.5	1-3	3.9	22	4.7	1.6
Brazos River.								
Kopperl, Tex.	345	21	1.2	2, 3	0.2	7-23	0.4	1.0
Waco, Tex.	285	24	3.9	1	3.1	23	3.5	0.8
Valley Junction, Tex.	215	40	4.7	13, 29	1.0	7	2.9	3.7
Hempstead, Tex.	140	40	0.3	1	−1.6	22-27	−0.9	1.9
Booth, Tex.	61	39	4.3	1-5	3.2	22-30	3.7	1.1
Colorado River.								
Ballinger, Tex.	489	21	1.4	1-7	1.2	19-30	1.3	0.2
Austin, Tex.	214	18	1.8	1-3, 26	0.9	14, 15, 18	1.3	0.9
Columbus, Tex.	98	24	7.5	1, 2	6.9	17, 30	7.2	0.6
Guadalupe River.								
Gonzales, Tex.	112	22	0.5	1-4, 10	0.3	14-20, 23, 24	0.4	0.2
Victoria, Tex.	53	16	1.6	30	0.8	6	1.1	0.8
Red River of the North.								
Moorhead, Minn. (5)	284	26	11.0	30	8.8	22	10.0	2.2
Kootenai River.								
Bonners Ferry, Idaho. (2)	123	24	8.9	16	1.4	5-9	2.8	7.5
Pend d'Oreille River.								
Newport, Wash.	86	14	3.1	23	−1.2	1	1.1	4.3
Snake River.								
Lewiston, Idaho	144	24	10.6	15	0.9	6, 7	3.1	9.7
Riparia, Wash.	67	30	11.0	16	1.9	8, 9	4.3	9.1
Columbia River.								
Wenatchee, Wash.	473	40	11.0	15	7.5	7	8.6	3.5
Umatilla, Oreg.	270	25	11.3	17	2.9	9	5.1	8.4
The Dalles, Oreg.	166	40	16.5	18	3.5	3-5	7.2	13.0
Willamette River.								
Albany, Oreg.	118	20	12.3	17	1.2	1, 4	5.9	11.1
Salem, Oreg.	84	20	15.1	16	0.3	2-4	6.7	14.8
Portland, Oreg.	12	15	16.0	18	3.1	7	7.9	12.9
Sacramento River.								
Kennett, Cal.	259	23	3.0	5	0.0	1, 2, 12-15, 18-20, 27-30	0.3	3.0
Red Bluff, Cal.	201	23	3.5	5	0.3	1, 2, 26	0.8	3.2
Colusa, Cal.	157	25	5.9	6	3.1	1, 2	3.8	2.8
Knights Landing, Cal.	100	......	6.3	7	3.0	1-4	3.9	3.3
Sacramento, Cal.	64	25	10.3	7	7.0	1	8.0	3.3
Rio Vista, Cal.	26	12	6.6	4	1.6	26	3.8	5.0
San Joaquin River.								
Pollasky, Cal.	......	......	0.5	6	−0.2	28-31	0.1	0.7
Lathrop, Cal.	49	15	2.0	8, 9	1.1	3, 4	1.5	0.9

Figures indicate number of days frozen. (*) 5 days missing.

Honolulu, T. H., latitude 21° 19′ north, longitude 157° 52′ west; barometer above sea, 38 feet; gravity correction, —0.057 inch, applied. November, 1906.

Day.	Pressure.*		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
							8 a. m.		8 p. m.		8 a. m.		8 p. m.				8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	Wet.	Relative humidity.	Wet.	Relative humidity.	Direction.	Velocity.	Direction.	Velocity.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	30.06	30.01	75.5	77.0	81	68	69.0	72	68.0	63	e.	16	e.	13	0.03	0.02	9	N.	e.	4	Cu.	e.
2	30.00	29.99	77.0	77.0	81	72	69.5	69	69.0	67	ne.	13	ne.	12	T.	T.	7	Cu.	e.	1	Cu.	e.
3	29.98	29.97	77.0	75.8	80	71	69.5	69	68.6	69	ne.	6	ne.	12	0.00	0.09	1 6	A.-s. Cu.	0 e.	2	Cu.	e.
4	29.98	29.97	78.0	75.1	84	71	69.0	63	72.0	86	ne.	1	n.	3	0.00	0.00	6 few.	Ci. Cu.	0 0	0	0	0
5	29.97	29.92	76.5	74.5	78	70	69.0	68	71.0	84	ne.	1	n.	4	0.00	0.00	8	Ci.-s.	0	0	0	0
6	29.90	29.87	76.0	74.0	81	67	68.0	66	70.0	82	ne.	1	n.	3	0.00	0.00	few.	Cu.	e.	0	0	0
7	29.90	29.89	76.0	75.0	79	69	69.0	70	69.8	77	ne.	2	ne.	4	0.00	0.00	few	Cu.	e.	7	Cu.	e.
8	29.96	29.99	76.0	75.0	81	70	68.5	68	69.5	76	ne.	2	ne.	3	0.00	0.00	0	0	0	0	0	0
9	30.01	30.04	77.0	75.5	83	72	68.3	64	72.0	84	w.	2	ne.	9	0.00	0.04	few.	Cu.	e.	2	S.-cu.	e.
10	30.05	30.02	78.4	77.0	83	73	70.0	66	72.0	79	ne.	8	e.	8	0.00	0.00	3	Cu.	e.	0	0	0
11	30.07	30.07	80.0	77.0	84	73	70.5	62	71.5	77	ne.	2	e.	8	0.00	0.00	3	Cu.	e.	0	0	0
12	30.07	30.08	77.5	76.3	82	71	69.5	67	70.0	73	n.	3	ne.	5	0.00	0.00	few.	Cu.	e.	2	Cu.	e.
13	30.07	30.04	78.5	77.0	83	73	69.0	62	68.0	63	ne.	5	ne.	9	0.00	0.00	few. 2	A.-s. Cu.	0 e.	0	0	0
14	30.04	29.99	78.0	76.0	82	72	69.5	65	69.0	70	ne.	6	ne.	6	0.00	T.	6	Cu.	e.	0	0	0
15	29.97	29.95	77.0	74.0	81	71	70.0	71	69.0	78	ne.	12	ne.	10	0.07	T.	4	Cu.	e.	2 few.	Cu. N.	e. e.
16	29.93	29.97	72.4	73.0	81	70	67.0	75	69.0	82	ne.	6	e.	4	0.03	0.07	10	S.	0	6	S.	e.
17	30.02	30.01	79.2	77.0	83	73	71.2	68	73.0	83	e.	2	ne.	1	0.00	0.00	few.	Cu.	0	0	0	0
18	30.00	29.96	77.4	76.5	82	74	69.2	66	72.0	80	ne.	5	e.	12	0.00	T.	5	Cu.	e.	few.	Cu.	e.
19	29.97	29.97	78.0	77.0	82	68	69.2	64	69.0	67	ne.	6	se.	14	T.	T.	1	Cu.	e.	7	Cu.	e.
20	29.99	29.95	78.0	74.0	81	72	69.0	63	69.0	78	ne.	5	ne.	6	0.01	0.01	few.	Cu.	e.	7 few.	Cu. N.	ne. e.
21	29.95	29.95	76.3	74.0	81	70	69.8	72	70.0	82	ne.	3	n.	4	0.03	0.00	4	Cu.	e.	1	Cu.	e.
22	29.95	29.94	75.0	75.0	80	72	70.5	80	70.0	78	ne.	7	ne.	15	T.	0.03	5 3	Cu. N.	e. e.	5 2	S. N.	e. e.
23	29.96	29.93	75.0	73.5	80	69	69.0	74	68.5	78	ne.	12	ne.	9	0.46	0.14	6	Cu.	e.	6	Cu.	e.
24	29.94	29.93	71.0	70.0	76	67	68.0	86	68.0	90	ne.	12	ne.	10	0.04	0.26	6	N.	e.	7	Cu.	e.
25	29.96	29.96	72.0	71.0	79	65	66.5	75	67.0	81	n.	6	n.	2	0.00	0.00	few.	Cu.	0	9	S.-cu.	e.
26	29.93	29.87	73.0	72.0	75	64	68.0	78	68.0	82	n.	4	ne.	15	0.00	0.20	3 5	A.-s. Cu.	se. e.	4	Cu.	e.
27	29.86	29.86	72.0	75.0	79	68	68.0	82	70.0	78	n.	2	e.	5	0.00	0.00	few.	Cu.	0	9	A.-s.	0
28	29.86	29.87	74.0	71.0	76	68	70.0	82	68.0	86	se.	4	e.	6	0.00	2.00	6 4	A.-s. S.	0 se.	7	S.	ne.
29	29.90	29.88	70.5	67.0	74	65	69.0	93	65.0	90	ne.	3	se.	4	1.41	0.74	10	S	sw.	10	N.	0
30	29.85	29.85	72.0	72.0	78	65	67.5	79	69.0	86	n.	4	n.	5	0.01	0.00	3	Ci.-cu.	se.	1	S.-cu.	e.
Mean....	29.970	29.957	75.8	74.5	80.3	69.8	69.0	71.3	69.5	78.3	ne.	5.4	ne.	7.4	2.09	3.60	4.2	Cu.	e.	3.4	Cu.	e.

Observations are made at 8 a. m. and 8 p. m., local standard time, which is that of 157° 30′ west, and is 5h and 30m slower than 75th meridian time. * Pressure values are reduced to sea level and standard gravity.

RAINFALL IN JAMAICA.

Thru the kindness of Dr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table.

The rainfall for November was therefore very near the average for the whole island. The greatest fall, 30.83 inches, occurred at Castleton Gardens, in the northeastern division; while the least, 0.89 inches, fell at Bull Bay in the southern division.

Comparative table of rainfall.
[Based upon the average stations only.]
NOVEMBER, 1906.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1906.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	23	12.97	13.39
Northern division	22	48	5.59	6.12
West-central division	26	22	6.77	5.51
Southern division	27	34	5.05	4.34
Means	100		7.60	7.34